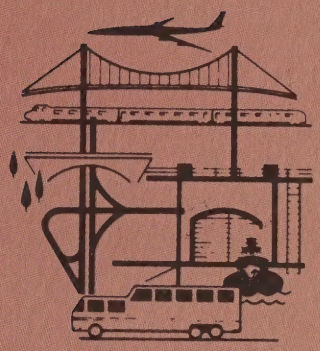
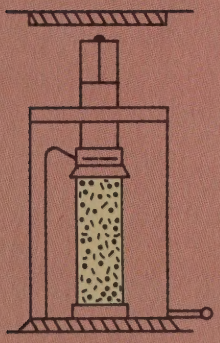
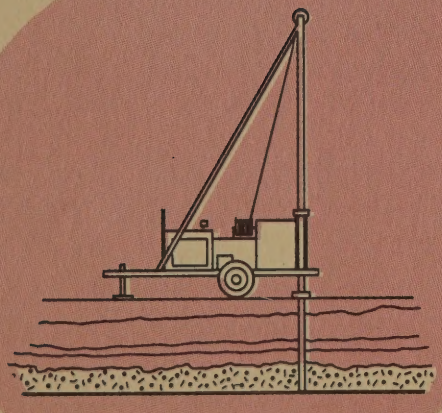
STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION

RAYMOND T. SCHULER, COMMISSIONER

SOIL MECHANICS
BUREAU







FOUNDATION DESIGN REPORT FOR DEPARTMENT OF ENVIRONMENTAL CONSERVATION

PROPOSED CATHEDRAL BROOK DAM BELLEAYRE MOUNTAIN SKI CENTER

PIN E10300701.19

NOVEMBER, 1973

DAY FILE COPY

NEW YORK STATE
DEPARTMENT OF TRANSPORTATION
Raymond T. Schuler, Commissioner

1220 Washington Avenue, State Campus, Albany, New York 12226

November 28, 1973

Mr. Henry L. Diamond
N.Y.S. Department of
Environmental Conservation
50 Wolf Road
Albany, New York 12205

Attention: Mr. Philip G. VanSantvoord

Dear Mr. Diamond:

Project: Proposed Cathedral Brook Dam
Belleayre Mountain Ski Center
PIN E10300701.19

Subject: Transmittal of Foundation Design Report

In accordance with your request to Mr. George W. McAlpin, Chief Engineer, dated March 7, 1973, and his subsequent authorization to this Bureau, we have completed our Foundation Investigation for the proposed Dam at Cathedral Brook.

This report, prepared by Mr. William R. Bellerjeau, Senior Soils Engineer, is based on an evaluation and analysis of the subsurface information obtained from seven drill holes progressed by the Department of Transportation Region 8 Soils Section and five percolation test pits progressed by personnel of this Bureau. Included in this report are foundation recommendations supplemented by detailed drawings including those showing subsurface conditions, earthwork related suggested specifications, laboratory test results and the driller's boring logs.

We will be pleased to discuss this report in detail with your representatives or provide any additional information or assistance you may require. We request that we be given the opportunity to review the final plans to insure that the final design is in conformance with this report. In addition, we recommend

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that we be contacted to assist your Project Engineer in the event that difficulties arise with the foundation and earthwork portions of the dam during construction and also, in particular to inspect the upstream liner trench installation.

Very truly yours,

Lyndon H. Moore, Director
Soil Mechanics Bureau

By

Bernard E. Butler

Bernard E. Butler
Associate Soils Engineer

BEB:WRB:MVM

Enc.

cc: Mr. G. W. McAlpin
Mr. M. N. Sinacori (2)

Purpose and Scope

The proposed Cathedral Brook dam will be used for impounding water for snow making operations at the Belleayre Ski Center. The dam will be a maximum of about 25 feet high and 240 feet long and will impound a maximum height of water of 24 feet. The water level will be subject to rapid fluctuations due to the demand for snow making operations.

This study and report has been prepared with the objective of providing the soils and foundations requirements for the design and construction of the dam.

Summary

The site is located in a steep sided valley where the soils are a glacial till composed of varying mixtures of gravel, sand and silt with a trace of clay containing numerous boulders. This soil material is quite variable in composition with seepage characteristics ranging from almost impervious to highly pervious. The soils in the valley floor in general seem more pervious than those on the valley sides. Ledge rock was not observed outcropping at any place in the valley walls nor was it encountered in any of the explorations. Ledge rock was observed, however, in a railroad cut section northeast of the site. Large springs were also noted at this cut as well as on the north valley side downstream and above the dam abutment location.

Three factors make the design of the dam at this location complex. One is the extremely variable composition of the till soils on the site whose variable permeability characteristics require extensive seepage control design measures. Secondly, access to the site is difficult resulting in the need to exploit the use of on-site material to the greatest extent possible. Thirdly, the anticipated rapid fluctuation of the water level of the reservoir behind the dam must be carefully accounted for to insure stability from this type of drawdown condition.

The following is a summary of the foundation recommendations offered in the body of this report.

1. The dam will have a one vertical on three horizontal upstream slope and a one vertical on two and one-half downstream slope.

2. The embankment material will be obtained from the pond area upstream of the dam and must be "scalped" to remove oversize stones and boulders.

3. The dam will require an impervious barrier to control seepage through and beneath the dam. Two alternates are proposed to accomplish this purpose. One is to line the upstream face of the dam with a Polyvinyl Chloride liner and extend the liner below existing ground surface into a cut-off trench. The other is to construct the dam and then install a slurry trench cut-off wall through the dam and below into the foundation soils.

4. Granular filter items will be needed for the Polyvinyl Chloride alternate to drain the dam embankment behind the liner and also protect against seepage below the dam for both alternates.

5. Your designers advise that the spillway will consist of six, five foot diameter corrugated metal pipes through the dam embankment. Seepage cut-off collars will be required for these pipes as shown on the typical sections.

Subsurface Conditions

The subsurface conditions as encountered in the explorations progressed at the site are shown on Drawing No. 8SM 2030B. In addition, the subsurface conditions in the general site area are discussed in the Terrain Reconnaissance Report included in the Appendix. The Subsurface Exploration Locations are shown on Drawing No. 8SM 2030A also included in the Appendix.

In general, the soils throughout the project area consist of glacial till materials composed of varying mixtures of sand, gravel, and silt with a trace of clay and containing numerous boulders. The driller's logs, gradation tests of selected samples from the drill holes and laboratory permeability tests on some of these samples all indicate that the soils are quite variable. This variability was also noticed in test pits dug for in-situ percolation tests at the site.

Inspection of the site and also the field percolation tests indicated that the surface soils are looser on the valley floor than on the sides of the valley. This difference in density is difficult to substantiate from the driller's logs alone since the casing and split spoon sampler blows indicate mostly very compact conditions in all holes, with the exception of the first few feet of the respective borings. These blow counts may be high also because of the presence of numerous stones and boulders. It is probable that the material on the valley floor has been loosened and reworked by water flow from the stream.

Gradation curves of samples from the drill holes are included in the Appendix to this report. Field percolation test results at five locations are shown on Drawing No. 8SM 2030A. The results of laboratory permeability tests on selected samples from the drill holes are shown below.

Drill Hole	Sample No.	Depth Ft.	Density @ Test PSF	Permeability Ft./Day
DND-4	J-2	5-6.5	115.0	12.0
	J-3	10-11.5	136.8	12.8
	J-4	15-16.5	125.7	16.2
-5	1	0-1.5	138.0	0.048
	2,3,4	5-16.5	142.0	0.0031
	5,6	20-27	138.6	0.0013
-7	2,3	5-11.5	120.6	7.41
	4	15-16.5	131.0	0.60
	5 through 12	20-59	134.9	0.0011
-8	2,3	5-11.5	121.9	0.436
-9	3,4	5-11.5	141.5	0.004
	5 through 9	15-44.5	123.5	0.23

These laboratory permeability tests results can only be considered as general indicators of the seepage characteristics of the in-situ soil because of the difficulty in simulating field conditions and the necessity of removing all gravel size material larger than 0.5 inches to successfully perform the tests.

Several large springs were noted in the north valley wall above and downstream of dam abutment. The combined flow of these springs appeared considerable, perhaps over 100 gallons per minute. No springs were noted in the abutment area, however, the ground was damp and there was slight seepage into percolation test pits dug in the area.

No ledge rock was observed in or along the valley walls and none was encountered in the drill holes, which were progressed to a maximum depth of 62.5 feet. It is interesting to note that bedrock was observed in a railroad cut located above and within one hundred yards of the north abutment. A large spring was observed emerging from what appeared to be the rock-soil interface at this location.

Foundation Recommendations

I. Dam and Spillway Configuration

The proposed dam will be constructed with an earth embankment section having six, five foot diameter corrugated metal pipe spillways. A typical section through the earth dam is shown on Drawing No. 8SM 2030C which is included in the Appendix. The dam, as shown, will have a one vertical on three horizontal upstream slope and a one vertical on two and one-half downstream slope with a minimum top width of 12 feet. Areas where scalped stones and boulders may be used are shown on the typical section and discussed in Section III of this report.

The spillway pipes, which are being designed by your office, reportedly will be large enough to handle twice the maximum design flow and, therefore, no emergency spillway is desired or considered necessary. The spillway pipes will require concrete seepage collars which would also resist any potential hydraulic forces caused by water flowing in the outlet pipe. These forces, if not accounted for, could possibly cause a downward movement or creep of the outlet pipe and tensile stresses at the welded joints. A concrete "thrust block" is recommended at the base or outlet end of the pipe to further resist hydraulic forces and also to provide resistance against possible uplift forces created at peak flows. The stone fill should be grouted in place over the outlet end of the spillway pipes to further resist this uplift force. The upstream head wall will be of stone fill which should also be grouted to resist scour.

An outlet drainage pipe and valve will be provided through the dam to evacuate the reservoir in case of emergency. This pipe can be reinforced concrete pressure pipe with positive mechanical joints or corrugated welded seam and joint metal pipe and should be capable of removing 90% of the storage below the lowest spillway crest within 14 days as recommended in the "Guideline For Small Earth Dams" prepared by your Department. Excavation and backfill for this pipe should be done in the dry and, therefore, dewatering and stream diversion may be necessary.

II Stability and Settlement

The foundation soils below the dam are very compact and predominately granular in nature. Therefore, the foundation of the dam will be stable for the embankment configuration proposed as long as proper seepage control measures are provided. Recommendations for seepage control are presented in Section IV of this report.

Settlement of the foundation soils beneath the dam will be negligible and any small settlements that may occur will take place during the embankment construction. It is not expected, therefore, that settlement will cause damage to the outlet or spillway pipes. Proper compaction of the earth embankment, as described in Section III will eliminate settlement within the dam embankment itself.

III Embankment Materials

Specifications for the dam embankment items are provided in the Appendix to this report and include Embankment Material, Stone Fill, Fine Filter Material and Coarse Filter Material.

Difficult access to the site makes it necessary to use on-site material which is satisfactory for the embankment item. The borrow for this purpose will be obtained from the pool area on the north side of the valley above the dam. All borrow areas should be specified on the final plans. Borrow should not be obtained from immediately adjacent to the upstream toe. The subsurface investigations and visual inspection of the site indicate that the borrow material will contain a large percentage of stones and boulders with a maximum dimension greater than six inches. Therefore, to obtain a satisfactory embankment material the borrow must be "scalped" of material greater than six inches. Gradation curves of 2 bag samples obtained from the borrow area are included in the Appendix as well as combined soil samples from DAD-7 located near the borrow area. The optimum moisture contents and maximum densities for the material represented by these curves is also shown. Also included are the Statewide Compaction Control Curves applicable to placement of this material.

The scalped stone material may be used as slope protection on the upstream face of the dam, as stream channel protection, or in other portions of the dam requiring stone fill.

Filter items will have to be brought to the site since the basic soil types available are not suitable for on-site processing.

IV Seepage Control

The dam embankment constructed of on-site materials can be expected to have a wide variation in permeability ranging from relatively impervious to almost free draining. Two alternate methods of treatment are proposed, therefore, to

control seepage through and beneath the dam embankment. Both these methods, while not providing a complete seepage cut-off below the dam, will prevent seepage through the dam embankment and thereby reduce the overall potential quantity of seepage and, in conjunction with the filter treatments, prevent piping and sloughing problems.

Alternate A: Polyvinyl Chloride Liner

A Polyvinyl Chloride liner with a minimum thickness of 20 mils may be installed just below the upstream face of the dam. To insure that the liner will not be displaced by possible hydrostatic pressures acting behind the liner during a rapid drawdown of the impoundment and also to prevent sloughing of the protective blanket over the liner during drawdown, filter materials will be required on both sides of the liner extending below the lowest expected drawdown level caused by the snow making operations. In addition the upstream face will require stone fill for protection of the filter items as shown on the Typical Section. The filter behind the liner must be positively drained through the dam embankment as shown on the Typical Section. The outlet and drainage pipes should be provided with seepage cut-off collars also shown on the Typical Section.

Construction of this liner must be done with great care and all surfaces upon which the liner will be placed must be free of sharp stones and objects that could puncture the liner. All embankment material placed against the liner should have a maximum top size of 2 inches for a distance of six inches from the liner and should be compacted to provide a smooth surface. A watertight liner is imperative for the safety of the dam.

The liner at the base of the dam should extend below the existing ground surface a minimum of five feet and a maximum as determined by the Engineer to provide cut-off through the loose more permeable surface material. This will result in only partial cut-off of seepage beneath the dam, therefore, filter items will be needed beneath the downstream toe of the dam to control piping.

The liner trench should be inspected during its construction by personnel from this Bureau to insure that as complete a seepage cut-off as is possible is attained through the loose, more pervious surface soil. Backfill of the trench should be in the dry and, therefore, dewatering may be necessary.

The dimensions and configuration of these required filter items are shown on the typical cross section on Drawing No. 8SM 2030C, included in the Appendix to this report.

Alternate B: Slurry Trench Cut-Off

A slurry trench cut-off may also be installed through the dam. With this method the entire embankment is first constructed and then the slurry trench installed through the existing embankment and into the foundation soils.

The slurry trench is constructed by digging a trench and keeping the sides stable by maintaining the trench full of a bentonite clay slurry mixture. This slurry provides a hydrostatic pressure on the trench sides thereby preventing their collapse. Upon completion of the trench, the slurry is displaced by lean concrete or a specified soil mixture which will mix with the slurry to provide the cut-off wall.

This method requires special equipment and is more costly to install than the liner but has the advantage of eliminating some of the filter items needed with the liner. Additional width of embankment may also be needed to accommodate the equipment necessary to install this trench.

The slurry trench should be carried through the foundation soils to provide some cut-off beneath the dam. However, because of the variability of the foundation soils complete cut-off may not be achieved and the downstream filter blanket is also recommended as for the liner alternate.

If this slurry trench method is utilized special construction procedures will be necessary where pipes must pass through the dam embankment. This requirement complicates this treatment method but can be analyzed further if this method is to be considered.

A Typical Section for this alternate is shown on Drawing No. 8SM 2030C.

V. Treatment of Springs

As stated in the discussion of subsurface conditions, there are existing springs in the hillside just downstream and above the north abutment area. Although no springs were noted in the areas covered by the abutments, special procedures should be included in the contract in the event that springs are uncovered during the excavation and stripping operations.

In general, these potential springs, if encountered, may be treated by isolating the area of seepage, placing coarse filter material around the point where the spring emerges to a depth of 2 feet, placing a six inch layer of fine filter over the coarse filter and leading the collected water from the coarse filter to the downstream toe of slope through a watertight pipe large enough to handle the flow. This pipe should also be provided with seepage collars to dissipate any pressure from flow seeping along the outside of the pipe. Each spring, however, should be inspected and evaluated in the field to be certain that this method will most satisfactorily solve the problem.

A typical cross-section of a treated spring is shown on Drawing No. 8SM 2030C, included in the Appendix to this report.

VI. General

It is recommended that this Bureau be requested to review the foundation aspects of the final plans. In this way we can assist your office in assuring that the plans incorporate the recommendations of this report.

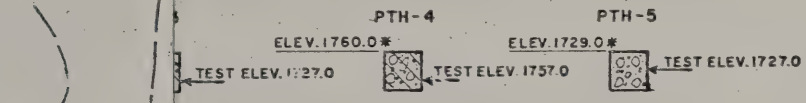
GENERAL NOTES

THE SUBSURFACE EXPLORATIONS SHOWN HEREON WERE MADE BETWEEN 4/4/73 AND 5/16/73

THE SOIL DESCRIPTIONS SHOWN ON THE SOIL PROFILES ARE AS DETERMINED IN THE MAIN OFFICE OF THE BUREAU OF SOIL MECHANICS BY A VISUAL INSPECTION OF THE SOIL SAMPLES.

THE OBSERVED WATER LEVELS AND/OR CONDITIONS INDICATED ON THE SOIL PROFILES ARE AS RECORDED AT THE TIME OF DRILLING. THESE WATER LEVELS AND/OR CONDITIONS MAY VARY CONSIDERABLY, WITH TIME, ACCORDING TO THE PREVAILING CLIMATE, RAINFALL AND OTHER FACTORS.

THE SUBSURFACE INFORMATION INDICATED ON THE SOIL PROFILES IS AS INTERPRETED BY THE MAIN OFFICE OF THE BUREAU OF SOIL MECHANICS FROM AN EXAMINATION OF THE BORING LOGS AND SOIL SAMPLES FROM THE VARIOUS EXPLORATIONS. REASONABLE CARE WAS TAKEN IN PERFORMING THIS WORK. THIS INFORMATION IS INTENDED FOR STATE DESIGN PURPOSES ONLY, AND IS MADE AVAILABLE TO BIDDERS ONLY THAT THEY MAY HAVE ACCESS TO IDENTICAL SUBSURFACE INFORMATION AVAILABLE TO THE STATE. IT IS PRESENTED IN GOOD FAITH, BUT IS NOT INTENDED AS A SUBSTITUTE FOR PERSONAL INVESTIGATIONS, INTERPRETATIONS OR JUDGMENT OF THE CONTRACTOR.



M PLAN CONTOURS
THE ABOVE TABULATION.
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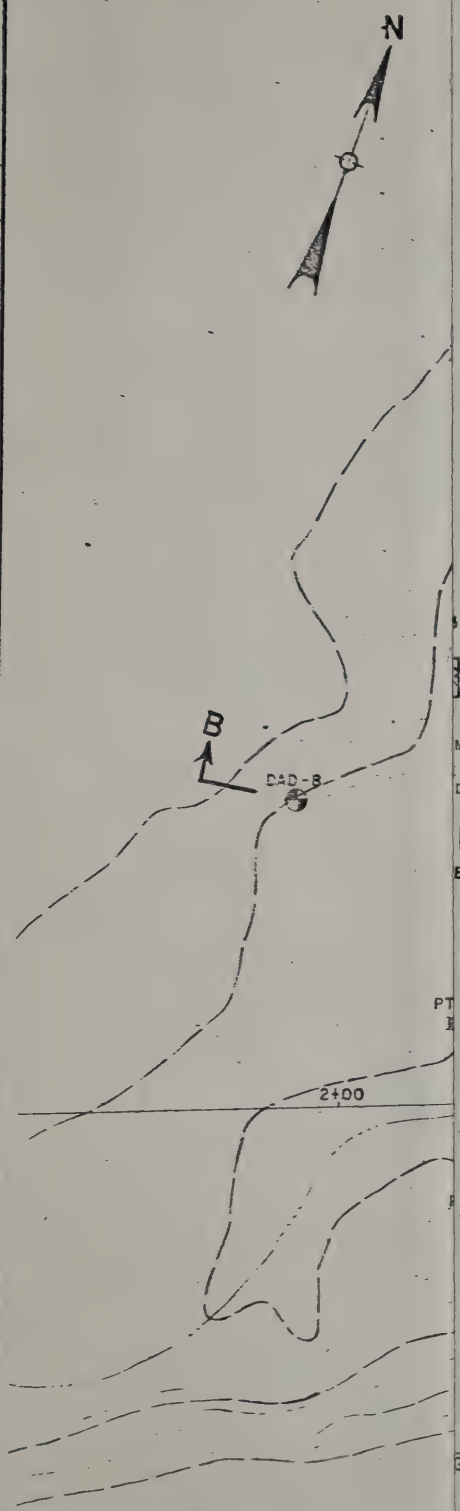


FOR SECTIONS SEE DRAWING NO. 8 SM 2030 B AND C

GEND

LACIAL TILL- Gr. Br. GRAVEL, with some Sand and Silt, with a trace of Clay containing Boulders (non-plastic)

LACIAL TILL- Gr. Br. GRAVEL, with some Sand and with trace of Silt containing Boulders (non-plastic)

OULDERS

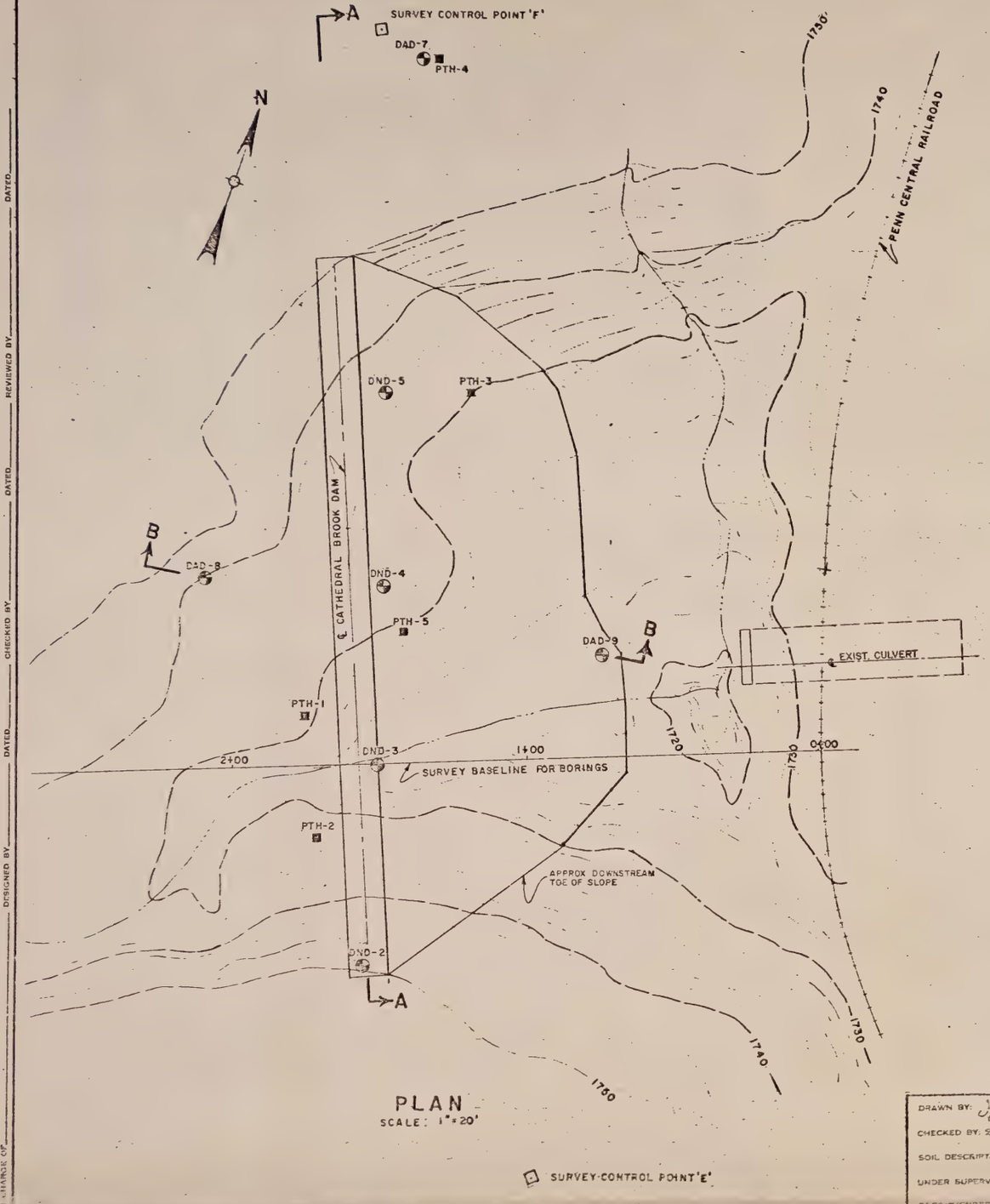
STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
SOIL MECHANICS BUREAU

FOUNDATION INVESTIGATION
PROPOSED CATHEDRAL BROOK DAM
BELLEAYRE MOUNTAIN SKI CENTER
P.I.N. E403-00.701.19
SUBSURFACE EXPLORATION LOCATION PLAN

APPROVED AUG 24 1973
L. H. Wood
DIRECTOR

REGION NO. 8
COUNTY ULSTER
DRAWING NO. 8 SM 2030 A

IN CHARGE OF _____ DESIGNED BY _____ DATED _____ CHECKED BY _____ DATED _____ REVIEWED BY _____ DATED _____



PERCULATION TESTS		
TEST HOLE	RUN NO.	TIME FOR 1" DROP
1	1	22 Sec.
	2	25 Sec.
	3	27 Sec.
	4	28 Sec.
	5	29 Sec.
	6	30 Sec.
	7	32 Sec.
	8	37 Sec.
	9	38 Sec.
2	1	4 Min. 9 Sec.
	2	4 Min. 49 Sec.
	3	5 Min. 53 Sec.
	4	6 Min. 39 Sec.
3		No Drop - Some seepage into TEST PIT.
4		No Drop - Water 3' below surface in adjacent DAD-7 which remained open for 10' plus
5	1	2 Min. 35 Sec.
	2	4 Min. 20 Sec.
	3	5 Min. 15 Sec.
	4	5 Min. 20 Sec.
	5	5 Min. 25 Sec.

GENERAL NOTES

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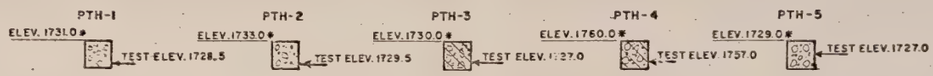


* - SURFACE ELEVATIONS OBTAINED FROM PLAN CONTOURS

NOTES: FOR PERCULATION TEST RESULTS SEE THE ABOVE TABULATION.
TEST PIT DEPTH APPROXIMATELY 3 FEET DEEP.

PTH-PROFILES

NOT TO SCALE

FOR SECTIONS SEE DRAWING NO. 8 SM 2030 B AND C

DESIGNED BY _____ DATED _____ REVIEWED BY _____ DATED _____ CHECKED BY _____ DATED _____ IN CHARGE OF _____

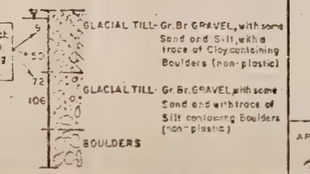
DRAWN BY: J.J. Mari
CHECKED BY: Arthur R. Magee
SOIL DESCRIPTIONS BY Wilson B. Magee
UNDER SUPERVISION OF: Albert E. Magee
RECOMMENDED FOR APPROVAL BY R. E. Burke

LEGEND

DRILL HOLE — DAD / DND / PTH
PERCULATION TEST HOLE

OBSERVED WATER LEVEL

Number of blows required to drive 3 1/2 inch O.D. (for DND holes) and 2 inch O.D. (for DAD holes) split spoon sampler one foot using a 300 lb hammer free falling 18 inches.

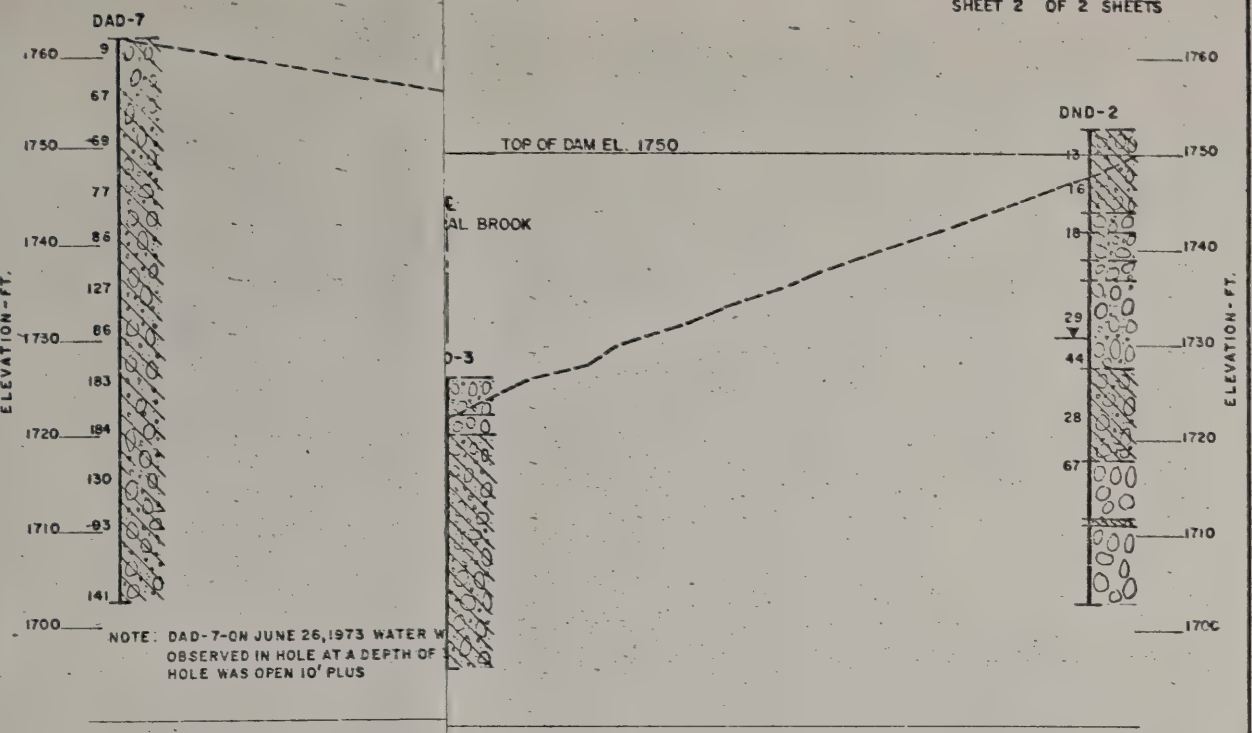


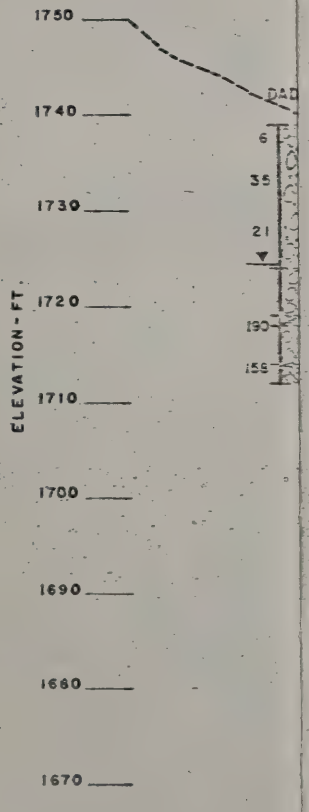
STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
SOIL MECHANICS BUREAU

FOUNDATION INVESTIGATION
PROPOSED-CATHEDRAL BROOK DAM
BELLEAYRE MOUNTAIN SKI CENTER
P.I.N. E403-00.701.19
SUBSURFACE EXPLORATION LOCATION PLAN

APPROVED AUG 24 1973
L. M. Moore
DIRECTOR

REGION NO. 8
COUNTY ULSTER
DRAWING NO. 8 SM 2030 A





DATED _____ DESIGNED BY _____ DATED _____ CHECKED BY _____ DATED _____ REVIEWED BY _____ DATED _____ IN CHARGE OF _____

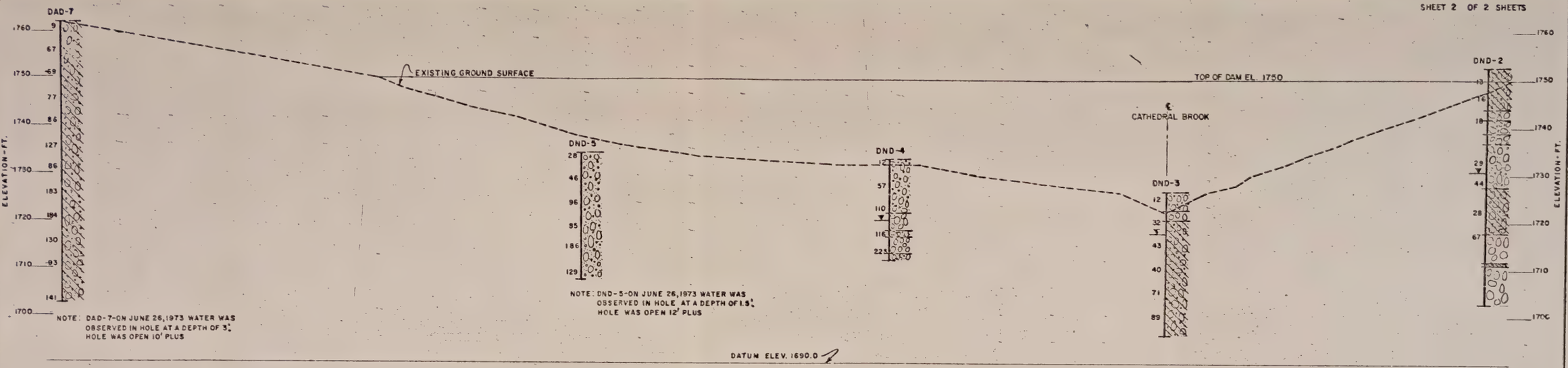
FOR TYPICAL SECTIONS SEE DRAWING NO. 8 SM 2030 C
FOR SUBSURFACE EXPLORATION LOCATION PLAN, GENERAL NOTES AND LEGEND SEE DRAWING NO. 6 SM 2030 A

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
SOIL MECHANICS BUREAU

FOUNDATION INVESTIGATION
PROPOSED CATHEDRAL BROOK DAM
BELLEAYRE MOUNTAIN SKI CENTER
P.I.N. E103-00.701.19
SECTIONS A-A AND B-B

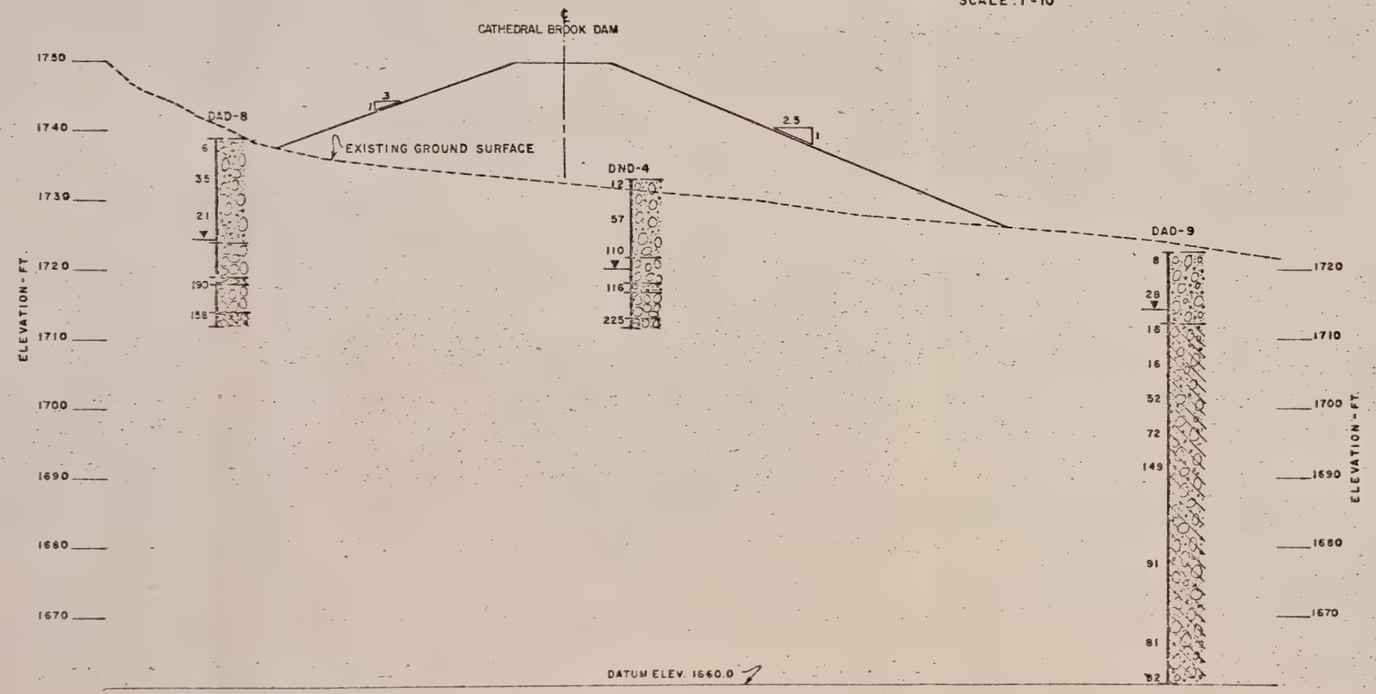
APPROVED AUG. 24 1973
L. H. Moore
DIRECTOR

REGION NO. 8
COUNTY ULSTER
DRAWING NO. 8 SM 2030 B



SECTION A-A

BORINGS PROJECTED TO SECTION LINE
SCALE: 1"=10'



SECTION B-B

BORINGS PROJECTED TO SECTION LINE
SCALE: 1"=10'

FOR TYPICAL SECTIONS SEE DRAWING NO. 8 SM 2030 C
FOR SUBSURFACE EXPLORATION LOCATION PLAN, GENERAL NOTES AND LEGEND SEE DRAWING NO. 8 SM 2030 A

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
SOIL MECHANICS BUREAU

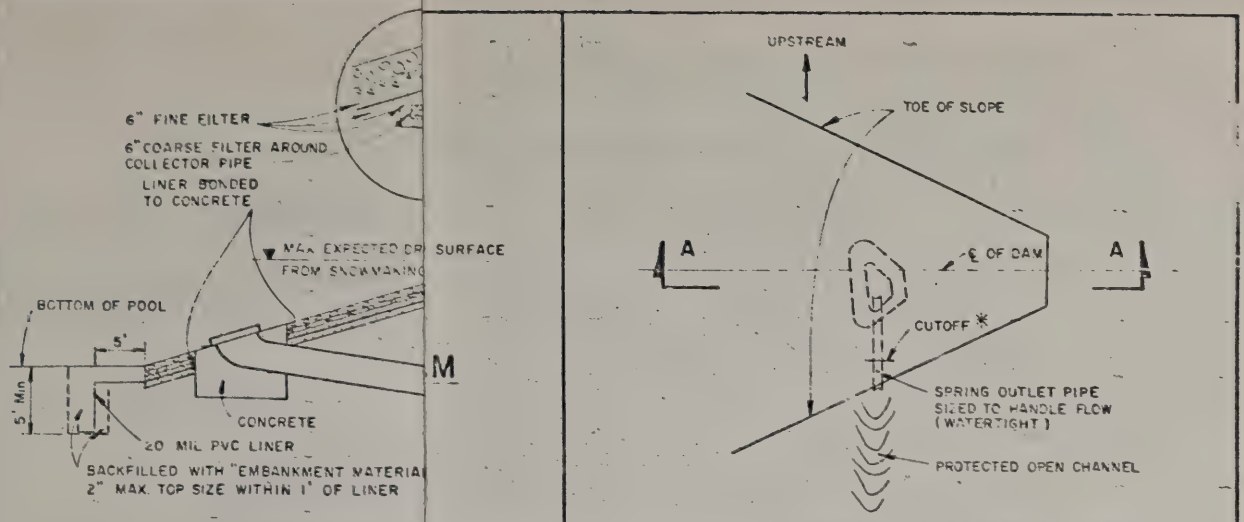
FOUNDATION INVESTIGATION
PROPOSED CATHEDRAL BROOK DAM
BELLEAYRE MOUNTAIN SKI CENTER
P.I.N. E103-00.701.19
SECTIONS A-A AND B-B

DRAWN BY: J.J. Mari
CHECKED BY: Alan K. Pelligian
SOIL DESCRIPTIONS BY: Alan K. Pelligian
UNDER SUPERVISION OF: Alan K. Pelligian
RECOMMENDED FOR APPROVAL BY: B. E. Butler

APPROVED Aug. 24 1973
L. H. Moore
DIRECTOR

REGION NO. 8
COUNTY ULSTER
DRAWING NO. 8 SM 2030 B

IN CHARGE OF ____ DESIGNED BY ____ DATED ____ CHECKED BY ____ DATED ____ REVIEWED BY ____ DATED ____



PLAN OF NORTH ABUTMENT AREA

SECTION A-A

TYPICAL SPRING TREATMENT

NOT TO SCALE

TYPICAL UPSTREAM SEC

PIPES

SCALE: 1" = 10

DETAIL "A"

1745

FOR SUBSURFACE EXPLORATION LOCATION PLAN AND SOIL PROFILES SEE DRAWING NOS. 8 SM 2030 A AND B.

STATE OF NEW YORK

DEPARTMENT OF TRANSPORTATION

SOIL MECHANICS BUREAU

FOUNDATION INVESTIGATION

PROPOSED CATHEDRAL BROOK DAM

BELLEAYRE MOUNTAIN SKI CENTER

P.I.N. E103-00.701.19

TYPICAL SECTIONS

APPROVED DEC. 7 1973

DIRECTOR

REGION 10 8

COUNTY ULSTER

DRAWING NO. 8 SM 2030 C

DESIGNED BY

CHECKED BY

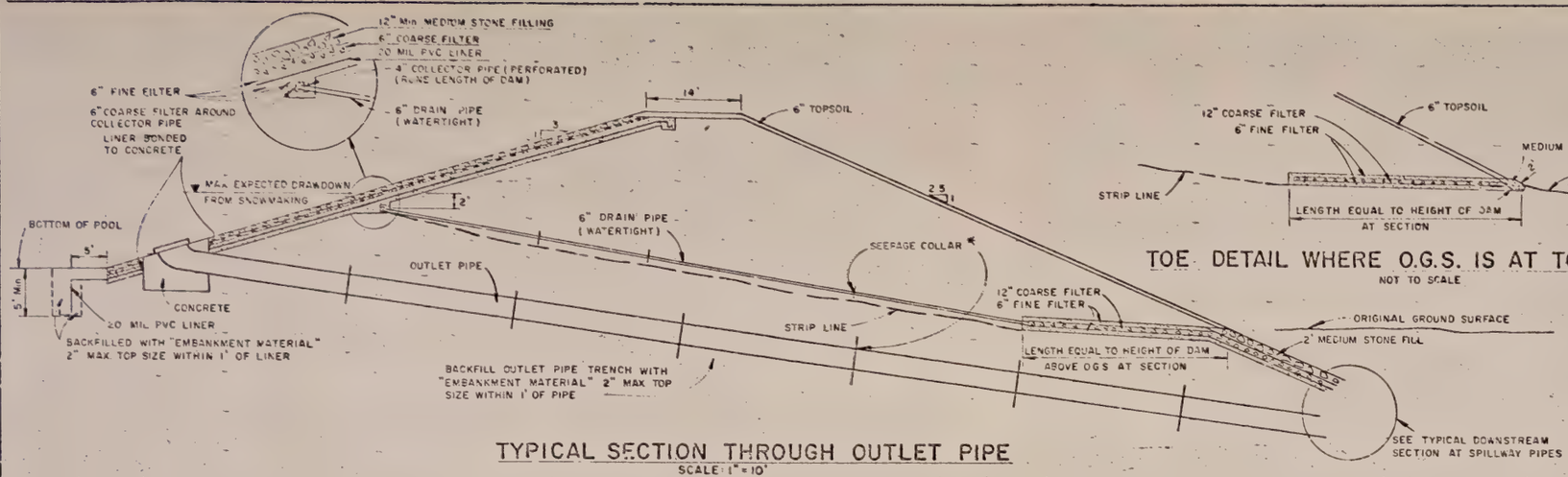
REVIEWED BY

DATED

DATED

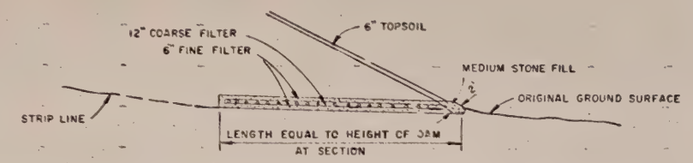
DATED

IN CHARGE OF



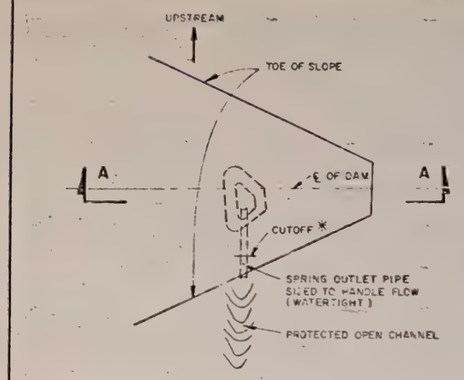
TYPICAL SECTION THROUGH OUTLET PIPE

SCALE: 1" = 10'

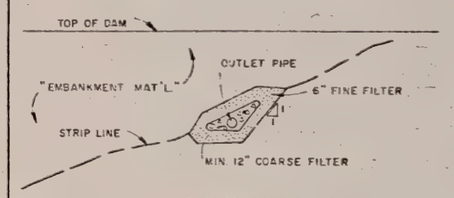


TOE DETAIL WHERE O.G.S. IS AT TOE OF DAM

NOT TO SCALE



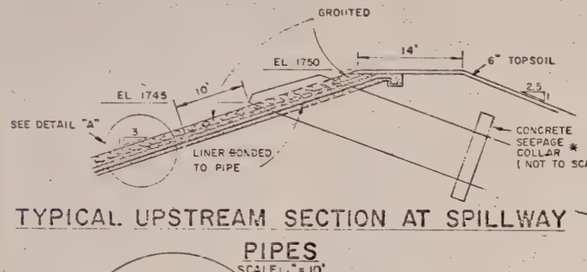
PLAN OF NORTH ABUTMENT AREA



SECTION A - A

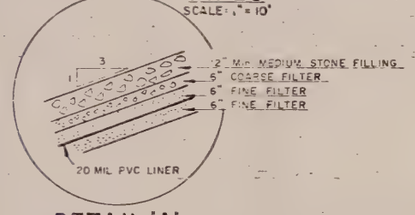
TYPICAL SPRING TREATMENT

NOT TO SCALE

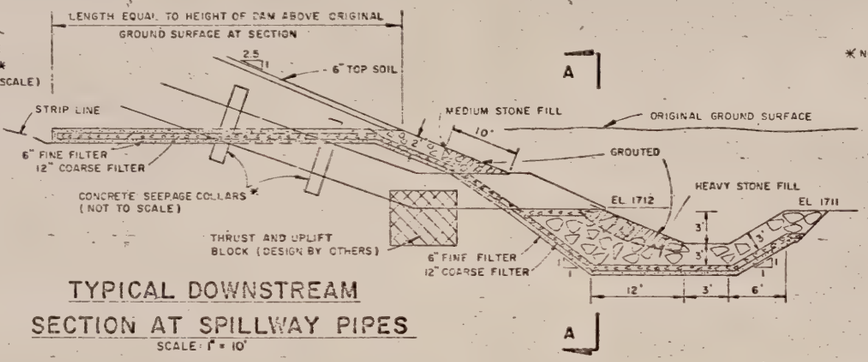


TYPICAL UPSTREAM SECTION AT SPILLWAY PIPES

SCALE: 1" = 10'



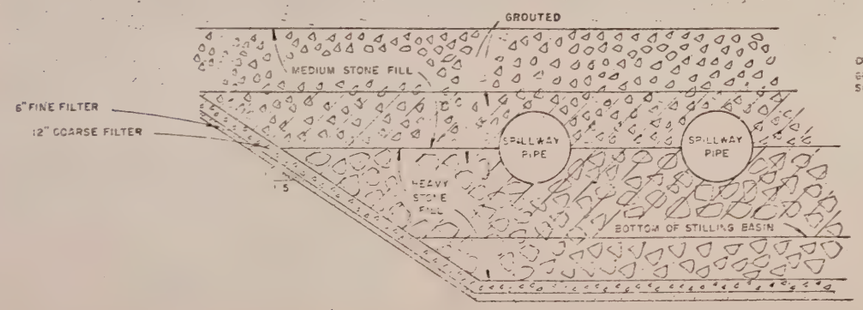
DETAIL "A"



TYPICAL DOWNSTREAM SECTION AT SPILLWAY PIPES

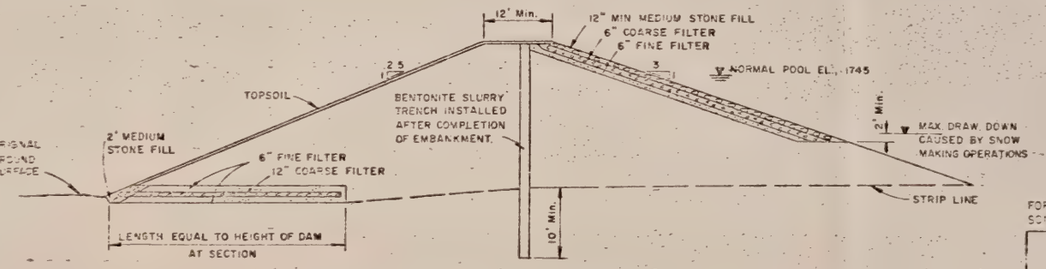
SCALE: 1" = 10'

* NOTE: FOR DESIGN OF SEEPAGE COLLARS SEE N.Y.S WATER RESOURSES COMMISSION INFORMATION CIRCULAR "GUIDELINES FOR SMALL EARTH DAMS" DATED OCTOBER 2, 1969.



SECTION A - A

SCALE: 1" = 5'



TYPICAL SECTION

DAM WITH BENTONITE SLURRY TRENCH CORE

SCALE: 1" = 10'

FOR SUBSURFACE EXPLORATION LOCATION PLAN AND SOIL PROFILES SEE DRAWING NOS. 8 SM 2030 A AND B.

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
SOIL MECHANICS BUREAU

FOUNDATION INVESTIGATION
PROPOSED CATHEDRAL BROOK DAM
BELLEAYRE MOUNTAIN SKI CENTER
P.I.N E103-CO. 701.19
TYPICAL SECTIONS

PREPARED BY:
DRAWN BY: F. Agostino
CHECKED BY: P. E. Butler

APPROVED Dec. 7 1973
DIRECTOR

REGION NO. 8
COUNTY ULSTER
DRAWING NO. 8 SM 2030 C

IN CHARGE OF ____ DESIGNED BY ____ DATED ____ CHECKED BY ____ DATED ____ REVIEWED BY ____ DATED ____

DAM AT CATHEDRAL BROOK
BELLEAYRE SKI CENTER

SUGGESTED SPECIFICATION FOR EMBANKMENT IN PLACE

All the requirements of Item 2B of the Public Works Specifications of 1962 shall apply, except as herein modified.

A. Earthfill

1. Preparation of Foundations: After the foundation under the earthfill portion of the dam has been stripped to the depths shown on the plans or ordered by the Engineer all free water shall be removed, and the foundation leveled and rolled as specified for the subsequent layers of earthfill or as ordered by the Engineer. Immediately prior to placement of the first layer of earthfill material the Contractor shall scarify the foundation.

2. Materials: Material placed within the embankment shall have a maximum dimension of six inches, and four inches within 3 feet of pipes and spillway sections. Material under this item shall be taken from the approved on-site borrow areas shown on the plans. This material will require scalping to remove particles larger than six inches. It is expected that a considerable quantity of plus 6 inch size material will be encountered. If the Contractor desires to use material from sources other than areas shown on the plans the borrow material from such areas shall be sampled and submitted for approval to the N.Y.S. D.O.T. Soil Mechanics Bureau.

3. Placing: The suitability, disposition, and location of placement of all earthfill materials shall be subject to the approval of and as ordered by the Engineer at all times. No layer shall be placed until the previous layer has been approved by the Engineer. The earthfill portion of the embankment shall be built up in long uniform layers with no abrupt changes in the elevation of the top surface. A transverse crown to properly drain the surface of the embankment shall be maintained at all times. At the start of each day's operation and at any other time as considered necessary, as ordered by the Engineer, the Contractor shall scarify the top or contact surface of the embankment before placing the next layer of material. No extra payment will be made for the operations described under this paragraph (3).

4. Compaction: All earthfill material placed under this item shall be placed in layers having a maximum thickness before compaction of eight inches, and shall then be compacted to not less than 95 percent of the maximum dry density as determined by the Engineer in accordance with A.A.S.H.O. Designation T-99, Method C. In no case shall the moisture content of the material when spread on the dam be greater than three percent wetter than, the Optimum Moisture Content as determined by the Engineer in accordance with A.A.S.H.O. Designation T-99, Method C. In no case shall the material be compacted at a moisture content less than three percent drier than the Optimum Moisture Content. All material placed in the dam under this item shall be compacted at a moisture content determined by the Engineer.

5. Structure Backfill: Embankment material adjacent to the outlet works structures shall be hand placed and compacted, using approved mechanical impact rammers to the requirements specified in paragraph (4). Special care shall be taken to insure adequate bond between structure and foundation soil or backfill.

6. Method of Measurement: The quantity of embankment to be paid for under this item will be the number of cubic yards of material measured in its final compacted position, placed as required by the plans and specifications within the payment limits shown on the plans unless otherwise ordered in writing by the Engineer. For computation of quantities of embankment, no deductions should be made in the area of any cross section for any pipe unless the end area is greater than four square feet.

7. Basis of Payment: The unit price bid per cubic yard for this Item shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that Furnishing Water Equipment and Applying Water will be paid for under their respective items.

   No direct payment will be made for any losses of material which may result from foundation settlement, erosion, removal of stones larger than 6 inches or any other cause. The cost of all losses or processing shall be included in the price bid for this Item.

Prepared By: N.Y.S. Dept. of Transportation
Soil Mechanics Bureau
November, 1973

DAM AT CATHEDRAL BROOK
BELLEAYRE SKI CENTER

SUGGESTED SPECIFICATIONS FOR FINE FILTER

A. Description: Under this item the Contractor shall furnish and place the fine filter as shown on the plans or as ordered by the Engineer.

B. Materials: All material furnished for this item shall be free from organic matter and shall have the following gradation.

Passing Sieve	Percent By Weight
1/4"	100
No. 4	90-100
No. 16	55-75
No. 50	10-30
No. 100	1-8
No. 200	0-5

Material meeting the gradation requirements of M-3, Fine Aggregate, of the Public Works Specifications of 1962 will be acceptable for this item.

C. Placing: Where fine filter is to be placed directly on the foundation soil, the soil shall be properly prepared by stripping of all sod and topsoil, and rolled to produce a smooth, uniform surface, to the limits shown on the plans and as ordered by the Engineer.

The fine filter material shall be placed and spread without segregation over the prepared surface in layers, and water added as approved by the Engineer. Compaction of individual layers will not be required. The fine filter shall be approved by the Engineer before any other type of material is placed upon it.

Should the fine filter become contaminated, or otherwise mixed with the adjacent materials through any cause whatsoever, the Contractor shall, at no expense to the State, correct any such deficiencies as approved by the Engineer. No traffic or hauling other than that necessary to place the next course will be permitted over the fine filter.

D. Method of Measurement: The quantity to be paid for under this item will be the number of cubic yards of material measured in its final position between the payment limits as shown on the plans or as ordered by the Engineer

in accordance with the specifications. No direct payment will be made for any losses of material which may result from shrinkage, compaction, foundation settlement, waste, overflow, erosion, leakage, or any other causes; the cost of such losses shall be included in the price bid for this item.

Prepared By: NYS Dept. of Transportation
Soil Mechanics Bureau
November, 1973

DAM AT CATHEDRAL BROOK
BELLEAYRE SKI CENTER

SUGGESTED SPECIFICATIONS FOR COARSE FILTER

A. Description: Under this item the Contractor shall furnish and place the coarse filter as shown on the plans or as ordered by the Engineer.

B. Material: All material furnished for this item shall have the following gradation:

Passing Sieve	Percent By Weight
1"	100
1/2"	90-100
1/4"	0-15

Material meeting the gradation requirements of M-4 Coarse Aggregate, No. 1 stone of the Public Works Specifications of 1962 will be acceptable for this Item.

C. Placing: The coarse filter shall be placed, without segregation and in a manner approved by the Engineer, in a single layer having a thickness equal to the full thickness indicated on the plans. No compaction other than that due to the hauling and grading equipment will be required.

Should the coarse filter material become contaminated or otherwise mixed with any adjacent materials through any cause whatsoever, the Contractor shall, at no expense to the State, correct any such deficiency, as approved by the Engineer. No traffic or hauling, other than that necessary to place the next course will be permitted over the coarse filter.

D. Methods of Measurement: The quantity to be paid for under this item will be the number of cubic yards, measured in its final position placed between the payment limits as shown on the plans or as ordered by the Engineer in accordance with the specifications. No direct payment will be made for any losses of material which may result from shrinkage, compaction, foundation settlement, waste, overflow, erosion, leakage, or any other causes; the cost of such losses shall be included in the price bid for this item.

Prepared By: N.Y.S. Dept. of Transportation
Soil Mechanics Bureau
November, 1973

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
SOIL MECHANICS BUREAU
NOVEMBER, 1973

SUGGESTED SPECIFICATIONS

Medium Stone Fill
Heavy Stone Fill

1. Description

Under these items the Contractor shall furnish and place the specified stone fill items at all locations shown on the plans or designated by the Engineer.

2. Materials

Materials furnished for use as stone filling shall be ledge rock fragments, field stone, coarse gravel and cobbles, material scalped from the embankment borrow material or other material conforming to the requirements shown below. Materials will be accepted for conformance on the basis of a visual examination by the Engineer.

Stone Filling Gradation Requirements

Stone Filling Item	Stone Size or Weight	Percent of Total By Weight
Medium Stone Fill	Heavier than 100 lbs.	50-100
	100 lbs. or lighter	0-50
Heavy Stone Fill	Heavier than 600 lbs.	50-100
	600 lbs. or lighter	0-50

NOTES:

1. Materials shall contain less than 20 percent of stones with a ratio of maximum to minimum dimension greater than three.

2. Materials shall contain a sufficient amount of stones smaller than the average stone size to fill the spaces between the larger stones.

3. Construction Details

Stone filling shall be placed on a layer of bedding or filter material, as shown on the plans or directed by the Engineer. Stone filling shall be placed in a manner which will produce a mass of stone with smaller stone fragments filling the spaces between the larger ones, so as to result in the minimum practicable percentage of voids. The final section of stone filling shall be in conformance with the lines, grades, and thicknesses shown on the plans. Stone filling shall be placed to its full thickness in one operation, unless otherwise specified in the proposal, and in such a manner that the underlying soil, bedding or filter material will not be displaced or worked into the layer of stone filling. The stone shall be so placed and distributed that there will be no pockets of uniform size material. Rearranging of individual stones by hand or by means of mechanical equipment may be required to secure the specified results.

4. Method of Measurement

The quantity to be paid for under these items will be the number of cubic yards of stone filling measured within the payment lines indicated on the plans, or within payment lines designated by the Engineer. Bedding material will not be included in the measured quantity of stone filling.

5. Basis of Payment

The unit price bid per cubic yard for these items shall include the cost of furnishing all materials, labor, and equipment necessary to satisfactorily complete the work, except that bedding material will be paid for under its appropriate pay item.

MEMORANDUM

DEPARTMENT OF TRANSPORTATION

DATE July 6, 1973

SUBJECT REQUEST FOR TERRAIN RECONNAISSANCE REPORT
PROPOSED IMPOUNDMENT, BELAIR MOUNTAIN SKI CENTER
ULSTER COUNTY, PIN E10300 701.19

FROM RICHARD H. BURNS, Associate Soils Engineer RHB

TO BERNARD E. BUTLER, Associate Soils Engineer

In response to the June 18, 1973 memorandum from William R. Bellerjeau, the following text is the Terrain Reconnaissance Report for the requested above subject project.

The terrain analysis of the proposed site is very simple and therefore short. The proposed site is in a widened section of a ravine bottom contained by relatively steep sides. The soil is deep over the whole area, in the bottom of the ravine as well as along the sides. Bedrock is evident only in one location in the immediate vicinity of the project. This exposure is located on the western side of the railroad cut immediately to the north of the project area. Whether this exposure is really bedrock or a very massive block should be determined, as the location of the bedrock surface in relation to ground surface could have a significant influence on type of dam chosen for this location. It is significant that bedrock is not evident near the surface anywhere else in the immediate vicinity nor has it been reached in the several drill holes put down at various locations.

The soil in the area does not show any great variation from one location to another in the immediate vicinity of the project. Characteristically the matrix of the soil is sandy silt containing granular particles of red or gray sandstone and shale ranging in size from coarse sand and gravel up to cobbles and large flat blocks several feet across. Below approximately two feet in depth the material becomes more consistantly granular with less of the fines in the matrix and fewer large blocks and cobbles. The underlying material may be well sorted sand or gravel with occasional lenses or layers of finer sand or silt at various intervals. The continuity of these lenses is not predictable in extent either horizontally or vertically even though the occurence is evident in drill hole samples. Overall the soil is very permeable and except for localized lenses of compact fine-grained material will transmit water readily.

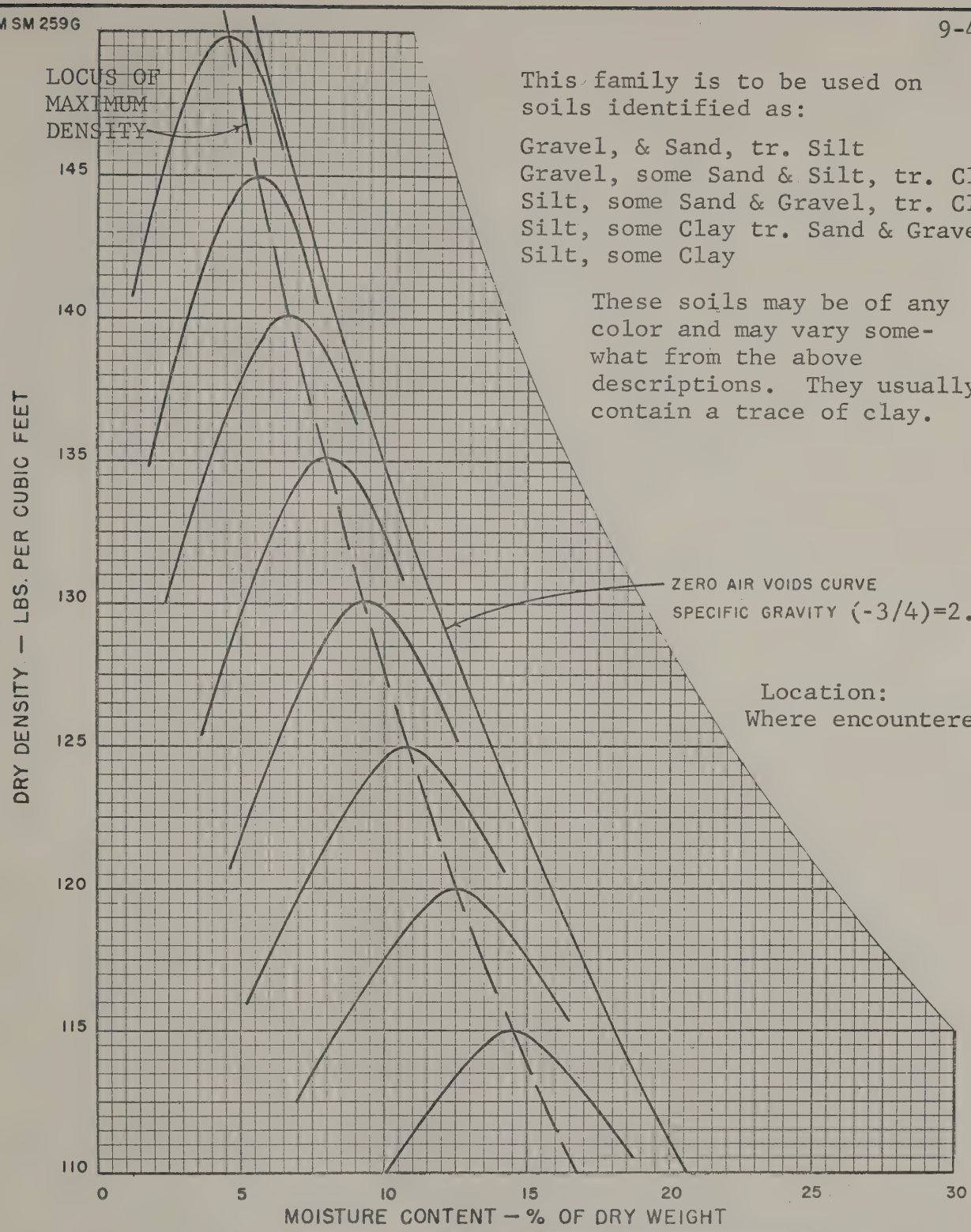
In addition to the stream which flows down the ravine groundwater is supplied to the area above the railroad embankment from the north sidehill of the ravine. This is the sidehill which contains the apparent bedrock showing in the railroad cut. This slope contains several springs and seep spots at different elevations which in combination yield a substantial quantity of water to the area of the dam location. This entire slope appears to be saturated and groundwater is evident within a foot of groundlevel in drill holes across the ravine along the approximate proposed line of the dam. Considering the permeability of the soil this may indicate significant containment problems in the design of an impoundment or containment.

The supply of construction materials in the vicinity is limited. Common fill may be available from the finer grained, less well-graded areas on site. Granular items up to the coarser gravel sizes should definitely be available on site, although durability may be questionable. Scalping of plus 4 inch material would appear to be not feasible since most of the material in this size is in the form of very large flat and massive blocks. Rip-rap and channel liner stone is not present. Some blocks of stone which may be adequate for such use are present along the slopes of the ravine, particularly upstream of the project site, but the feasibility of extracting and transporting them appears improbable. Impervious material is present only in limited locations at various depths as indicated by drill logs. Quantities and locations are indefinite and should be explored more precisely if required. No presently known quantities of impermeable materials are available in the immediate area of the project.

RHB:AY:vav

FORM SM 259G

9-4a



This family is to be used on soils identified as:

Gravel, & Sand, tr. Silt
Gravel, some Sand & Silt, tr. Clay
Silt, some Sand & Gravel, tr. Clay
Silt, some Clay tr. Sand & Gravel
Silt, some Clay

These soils may be of any color and may vary somewhat from the above descriptions. They usually contain a trace of clay.

Location:
Where encountered.

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

COMPACTION CONTROL CURVES
TILLS, SILTS, CLAYS AND WELL GRADED GRAVELS
(Greater than 115 p.c.f.)

Sheet 1a of 2 Sheets

DRAWN BY EJ CHECKED BY WPH

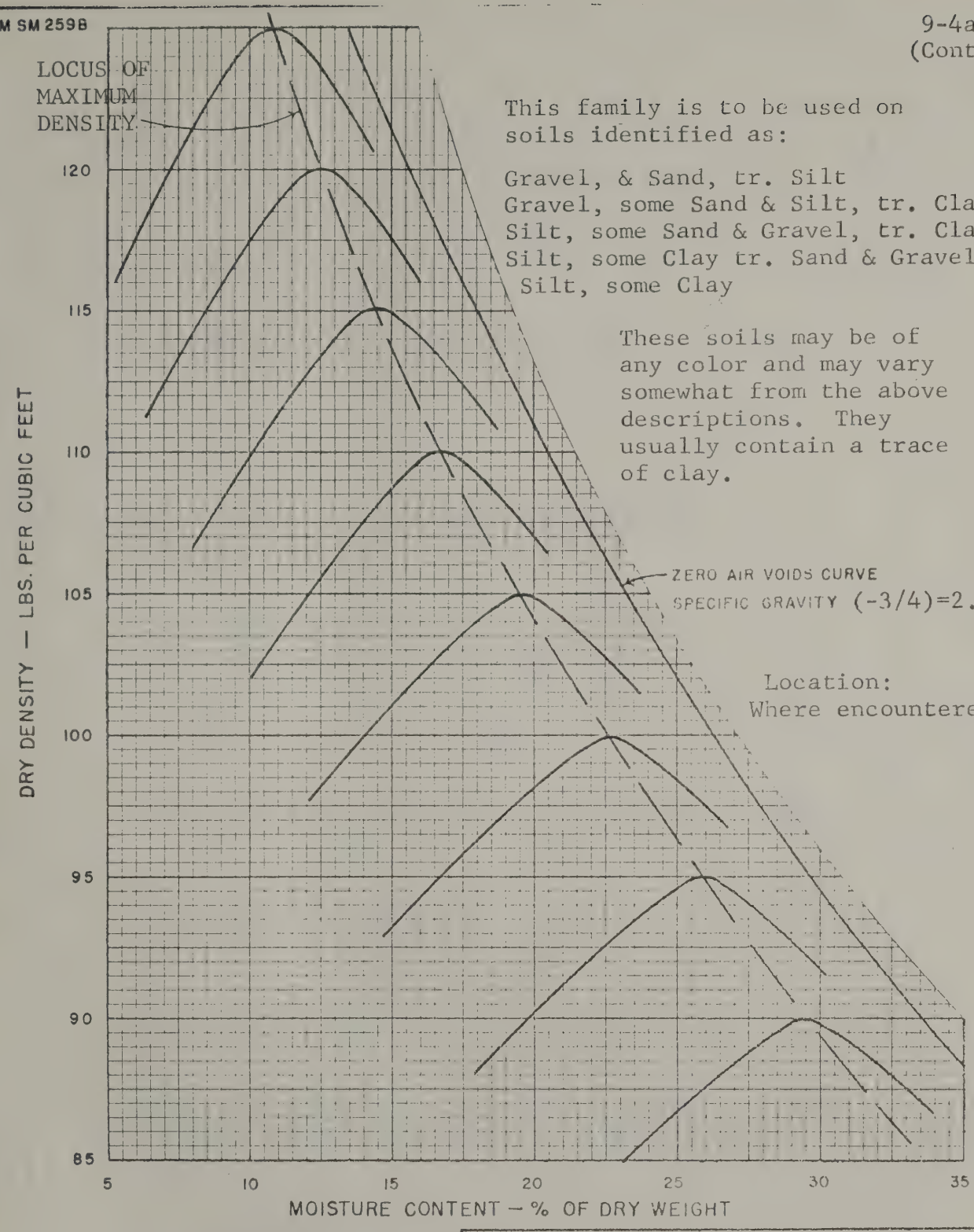
APPROVED 1/10 1966
Wm P Hoffmann
W. P. HOFFMANN
PRINCIPAL SOILS ENGINEER

DISTRICT NO. All
COUNTY All

DRAWING NO. SM 1667AR1

FORM SM 259B

9-4a
(Cont.)



This family is to be used on soils identified as:

Gravel, & Sand, tr. Silt
Gravel, some Sand & Silt, tr. Clay
Silt, some Sand & Gravel, tr. Clay
Silt, some Clay tr. Sand & Gravel
Silt, some Clay

These soils may be of any color and may vary somewhat from the above descriptions. They usually contain a trace of clay.

Location:
Where encountered.

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

COMPACTION CONTROL CURVES
TILLS, SILTS AND CLAYS
(Less than 115 p.c.f.)

Sheet 1b of 2 Sheets
Continuation of Sheet 1a

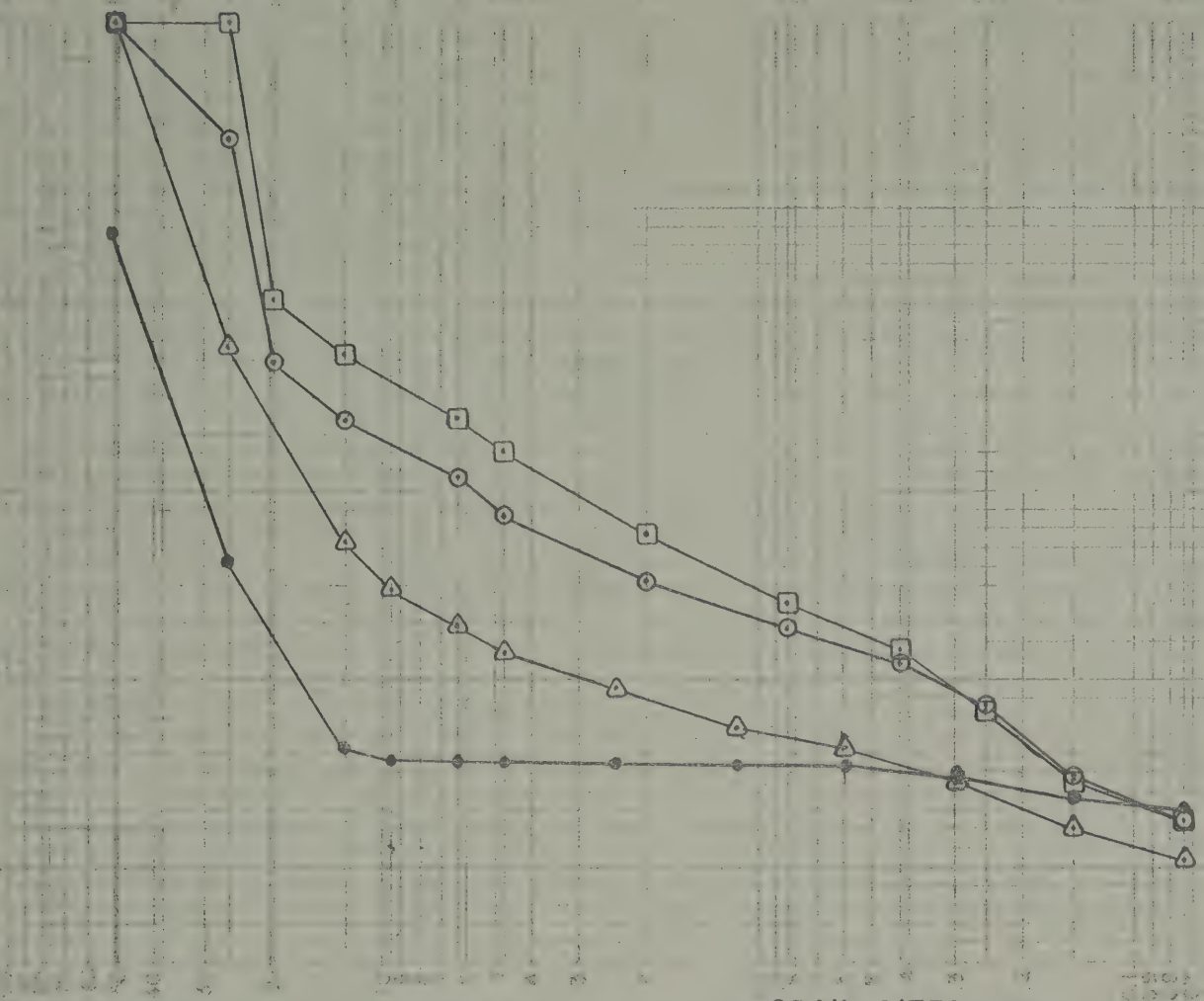
APPROVED 1/10 1966
Wm. P. Hoffmann
W. P. HOFFMANN
PRINCIPAL SOILS ENGINEER

DISTRICT NO. A11
COUNTY A11

DRAWN BY DJ CHECKED BY WPH

DRAWING NO. SM 1667AR1

SIEVE NUMBERS - U.S. ST'D.



PERCENT FINER THAN SIZE SHOWN

LEGEND
Drill Hole DND-2

Symbol	Sample No.	Depth Ft.
●	J-3,4	5-12.5
⊙	J-5	20-21.5
△	J-7	30-31.5
⊡	J-8	35-36

GRAIN SIZES - mm

COARSE	FINE	COARSE	FINE		
GRAVEL		SAND		SILT	CLAY

PROJECT Dam at Belleayre Mt. Ski Center P.I.N. E10300701.19
SAMPLE NO. _____ REGION NO. 8 COUNTY Ulster
STATION _____ OFFSET _____ DEPTH _____
DATE 9/10/73 DRAWN BY J. J. Masi CHECKED BY W. R. Bellerjeau

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
DIVISION OF CONSTRUCTION
SOIL MECHANICS BUREAU
GRAIN SIZE DISTRIBUTION CURVE

SIEVE NUMBERS - U.S. ST'D.

PERCENT FINER THAN SIZE SHOWN

LEGEND
Drill Hole DND-3

Symbol	Sample No.	Depth Ft.
⊡	J-3	6-7.5
●	J-4	10-11.5
△	J-5	15.5-16
⊙	J-6	20-21.5

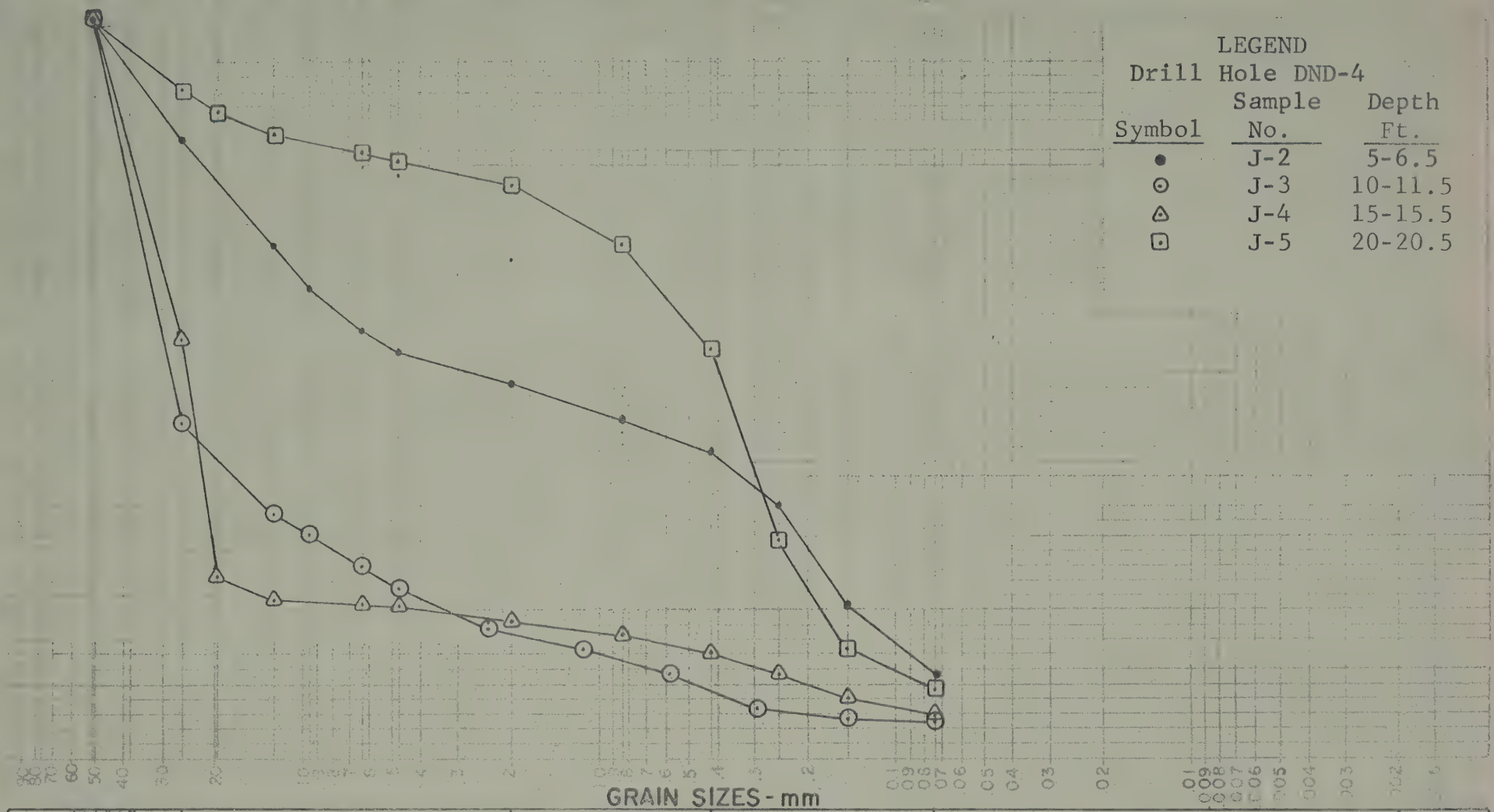
GRAIN SIZES - mm

GRAVEL		SAND		SILT	CLAY
COARSE	FINE	COARSE	FINE		

PROJECT Dam at Belleayre Mt. Ski Center P.I.N. E10300701.19
SAMPLE NO. _____ REGION NO. 8 COUNTY Ulster
STATION _____ OFFSET _____ DEPTH _____
DATE 9/10/73 DRAWN BY J.J. Masi CHECKED BY W. R. Bellerjeau

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
DIVISION OF CONSTRUCTION
SOIL MECHANICS BUREAU
GRAIN SIZE DISTRIBUTION CURVE

SIEVE NUMBERS - U.S. ST'D.



PROJECT Dam at Belleayre Mt. Ski Center P.I.N. E10300701.19

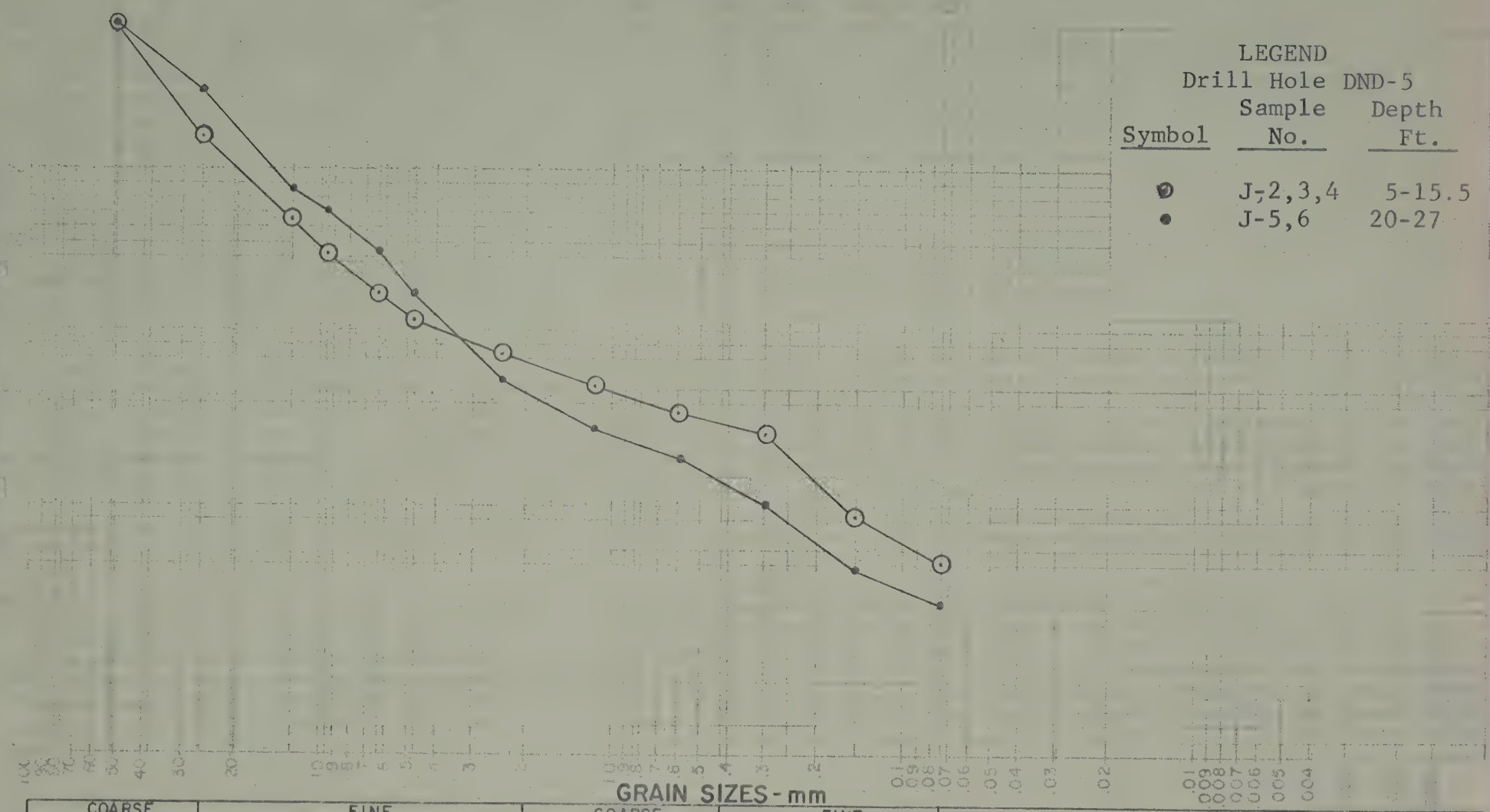
SAMPLE NO. _____ REGION NO. 8 COUNTY Ulster

STATION _____ OFFSET _____ DEPTH _____

DATE 9/10/73 DRAWN BY J.J. Masi CHECKED BY W. R. Bellerjeau

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
DIVISION OF CONSTRUCTION
SOIL MECHANICS BUREAU
GRAIN SIZE DISTRIBUTION CURVE

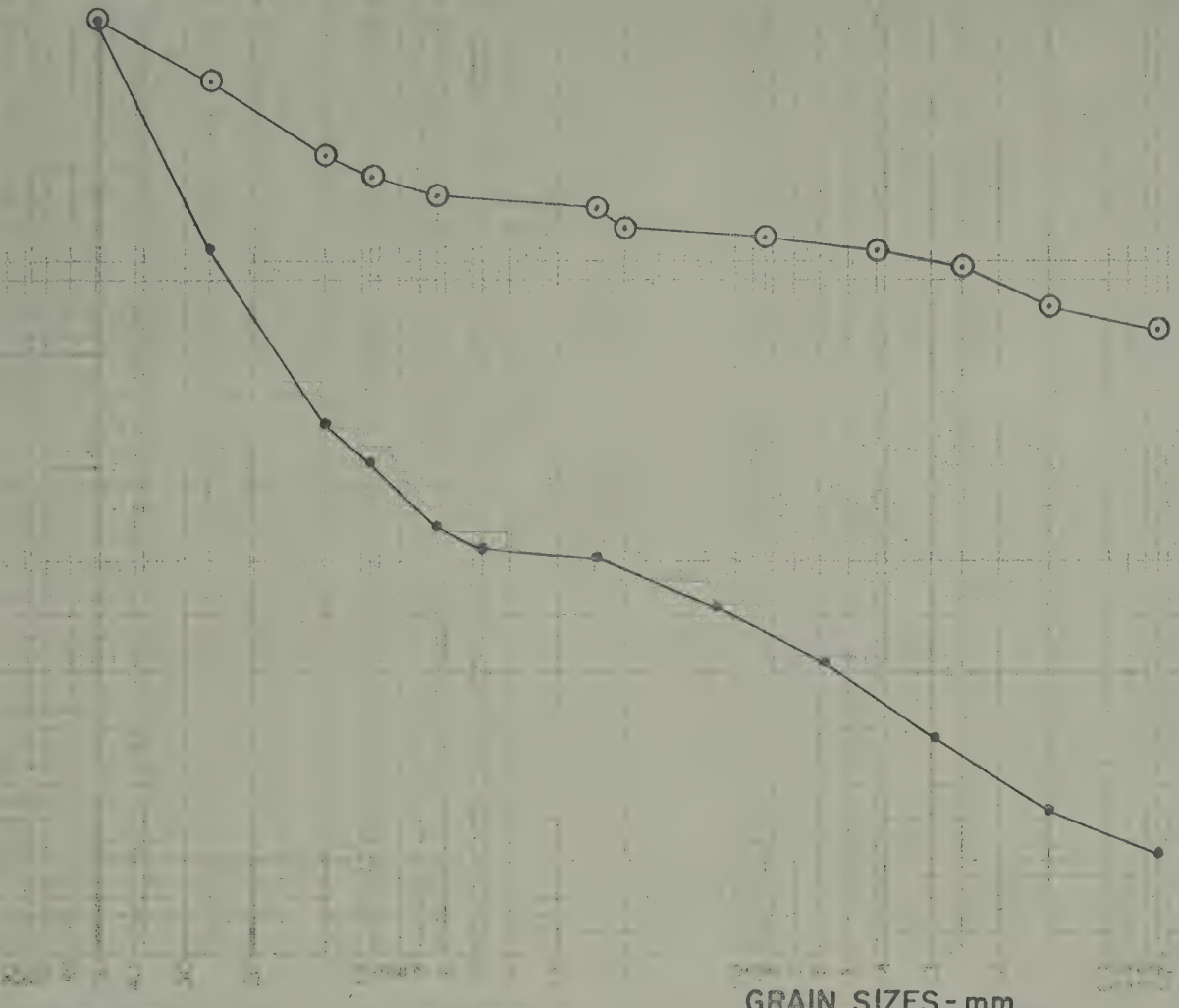
SIEVE NUMBERS - U.S. ST'D.



PROJECT Dam at Belleayre Mt. Ski Center P.I.N. E10300701.19
SAMPLE NO. ____ REGION NO. 8 COUNTY Ulster
STATION ____ OFFSET ____ DEPTH ____
DATE 9/10/73 DRAWN BY J.J. Masi CHECKED BY W.R. Bellerjeau

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
DIVISION OF CONSTRUCTION
SOIL MECHANICS BUREAU
GRAIN SIZE DISTRIBUTION CURVE

SIEVE NUMBERS - U.S. ST'D.



PERCENT FINER THAN SIZE SHOWN

LEGEND
Drill Hole DAD-7

Symbol	Sample No.	Depth Ft.
●	J-2,3	5-11.5
◉	J-4	15-16.5

GRAIN SIZES - mm

GRAVEL		SAND		SILT	CLAY
COARSE	FINE	COARSE	FINE		

PROJECT Dam at Belleayre Mt. Ski Center P.I.N. E10300701.19
SAMPLE NO. _____ REGION NO. 8 COUNTY Ulster
STATION _____ OFFSET _____ DEPTH _____
DATE 9/10/73 DRAWN BY J.J.Masi CHECKED BY W. R. Bellerjeau

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
DIVISION OF CONSTRUCTION
SOIL MECHANICS BUREAU
GRAIN SIZE DISTRIBUTION CURVE

SIEVE NUMBERS - U.S. ST'D.

PERCENT FINER THAN SIZE SHOWN

LEGEND
Drill Hole DAD-8

Symbol	Sample No.	Depth Ft.
•	J-2,3	5-11.5

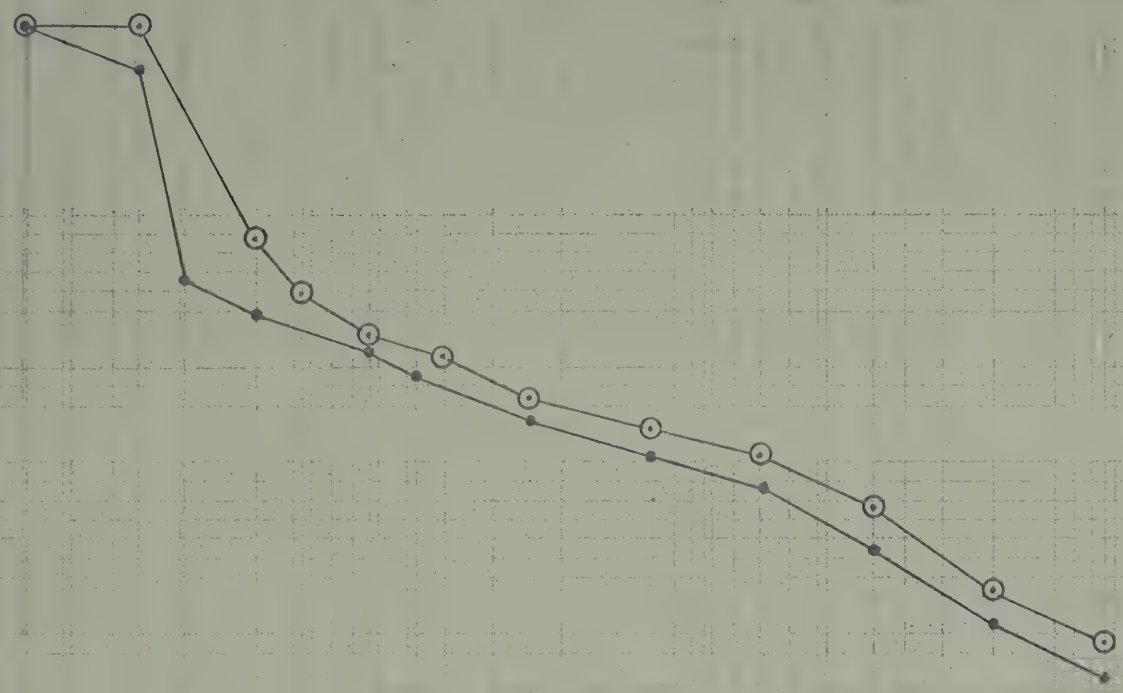
GRAIN SIZES - mm

GRAVEL		SAND		SILT	CLAY
COARSE	FINE	COARSE	FINE		

PROJECT Dam at Belleayre Mt. Ski Center P.I.N. E10300701.19
SAMPLE NO. _____ REGION NO. 8 COUNTY Ulster
STATION _____ OFFSET _____ DEPTH _____
DATE 9/10/73 DRAWN BY J.J. Masi CHECKED BY W. R. Bellerjeau

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
DIVISION OF CONSTRUCTION
SOIL MECHANICS BUREAU
GRAIN SIZE DISTRIBUTION CURVE

SIEVE NUMBERS - U.S. ST'D.



PERCENT FINER THAN SIZE SHOWN

LEGEND
Drill Hole DAD-9

Symbol	Sample No.	Depth Ft.
●	J-3,4	5-10.5
◉	J-5,6,7, &8	15-34.5

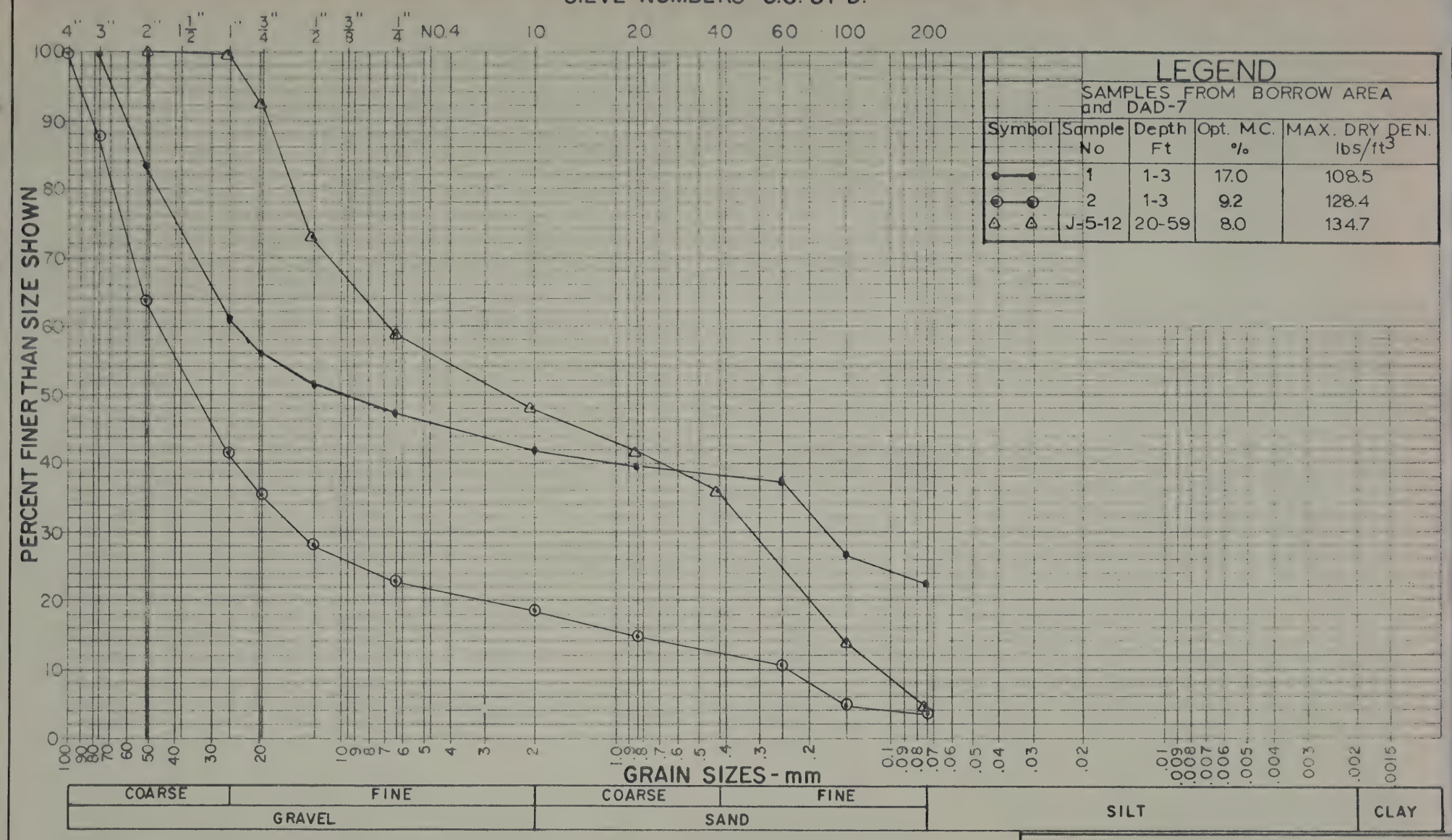
GRAIN SIZES - mm

GRAVEL		SAND		SILT	CLAY
COARSE	FINE	COARSE	FINE		

PROJECT Dam at Belleayre Mt. Ski Center P.I.N. E10300701.19
SAMPLE NO. _____ REGION NO. 8 COUNTY Ulster
STATION _____ OFFSET _____ DEPTH _____
DATE 9/10/73 DRAWN BY J. J. Masi CHECKED BY W. R. Bellerjeau

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
DIVISION OF CONSTRUCTION
SOIL MECHANICS BUREAU
GRAIN SIZE DISTRIBUTION CURVE

FORM SM 37-2(1/73)



LEGEND

SAMPLES FROM BORROW AREA and DAD-7

Symbol	Sample No	Depth Ft	Opt. M.C. %	MAX. DRY DEN. lbs/ft^3
●—●	1	1-3	17.0	108.5
◎—◎	2	1-3	9.2	128.4
△ △	J-5-12	20-59	8.0	134.7

PROJECT Dam at Belleayre Mt. Ski Center P.I.N. E10300701.19

SAMPLE NO. _____ REGION NO. 8 COUNTY Ulster

STATION _____ OFFSET _____ DEPTH _____

DATE 11/20/73 DRAWN BY S. Sgambati CHECKED BY Wm. Bellerjeau

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
DIVISION OF CONSTRUCTION
SOIL MECHANICS BUREAU
GRAIN SIZE DISTRIBUTION CURVE

SM 282d (2/72)

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
SOIL MECHANICS BUREAU

SUBSURFACE EXPLORATION LOG

REGION 8
COUNTY Ulster
PIN E103.00 701 19
PROJECT Proposed Dam at Belair Mtn. Ski Center
SOIL SERIES
COORD. LOC. N778,505 E465,540
DATE START 4-4-73 DATE FINISH 4-30-73

HOLE DND-2
LINE BSM $\mathbb{L}$
STA 1+56
OFFSET 68' Lt.
SURF. ELEV. 1752.7
DEPTH TO WATER *

CASING O.D. 4¼" I.D. 4" WEIGHT OF HAMMER - CASING 300 LBS. HAMMER FALL - CASING 18 IN
SAMPLER O.D. 3⅜" I.D. 3" WEIGHT OF HAMMER - SAMPLER 300 LBS. HAMMER FALL - SAMPLER 18 IN

DEPTH BELOW SURFACE	BLOWS ON CASING	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	DESCRIPTION OF SOIL AND ROCK	MOIST CONT %
0	DBH	1	D	B	H		Moist brown gravel, some sand & silt	
	5							
	5	2	7	6	9		Moist brown silt, some sand & gravel	
	44							
	80							
	130	3	8	8	10			
	135						Moist brown sand, some gravel, trace of silt	
	133							
10'	417							
	497						Boulder Rec. 18" 4 pcs.	
	49							
	300	4	15	13	17			
	238						Moist brown sand, some gravel, trace of silt	
	243							
	582						BOULDER Rec. 11" 3 pcs.	
	200							
	255							
	165							
20'	260							
	293							
	82	5	15	14	20			
	87							
	150						Moist brown sand, some gravel, trace of silt	
	210							
	614							
	777	6	25	19	32			
	226							
	320							
	325							
30'	383							
	94	7	15	13	15			
	162							
	170						Moist brown sand & gravel, trace of silt	
	240							
	352							
	207	8	22	45			Moist brown sand, some gravel, trace of silt	
	606						Boulder Rec. 13" 4 pcs.	
	347						Lost sample from 37'6" to 38'	
	1110							
40'	692						Boulders REc. 11" 4 pcs. used dynamite	
	1190							
	1220						Moist brown sand, some gravel, tr. of silt	
	715							
	911						Drilled boulders fr. 41' 6" to 50'	
	1520						Rec. 34" 11 pcs.	
							*Water encountered at 22'	
50'							Bottom of boring 50'	

THE SUBSURFACE INFORMATION SHOWN HEREON WAS OBTAINED FOR STATE DESIGN AND ESTIMATE PURPOSES. IT IS MADE AVAILABLE TO AUTHORIZED USERS ONLY THAT THEY MAY HAVE ACCESS TO THE SAME INFORMATION AVAILABLE TO THE STATE. IT IS PRESENTED IN GOOD FAITH, BUT IS NOT INTENDED AS A SUBSTITUTE FOR INVESTIGATIONS, INTERPRETATION OR JUDGMENT OF SUCH AUTHORIZED USERS.

CONTRACTOR _____ SM _____

DRILL RIG OPERATOR Michael Betanzos
SOIL & ROCK DESCRIP. R. B. Hanke
REGIONAL SOILS ENGR. W. M. Manning
SHEET 1 OF 1
STRUCTURE NAME/NO.

HOLE DND #2

SM 282d (2/72)

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
SOIL MECHANICS BUREAU

SUBSURFACE EXPLORATION LOG

REGION 8
COUNTY Ulster
PIN E103.00 701 19
PROJECT Proposed Dam at Belair Mtn. Ski Center
SOIL SERIES
COORD. LOC. N778,575 E465,545
DATE START 5-1-73 DATE FINISH 5-3-73

HOLE DND-3
LINE BSM B
STA 1+50
OFFSET ℄
SURF. ELEV. 1726.4
DEPTH TO WATER *

CASING O.D. 4¼" I.D. 4" WEIGHT OF HAMMER - CASING 300 LBS. HAMMER FALL - CASING 18 IN
SAMPLER O.D. 3½" I.D. 3" WEIGHT OF HAMMER - SAMPLER 300 LBS. HAMMER FALL - SAMPLER 18 IN

DEPTH BELOW SURFACE	BLOWS ON CASING	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	DESCRIPTION OF SOIL AND ROCK	MOIST CONT %
0	5	1	D	B	H		#1 Dug by hand	
	2	2	7	5	9		Moist brown sand, some gravel, trace of silt	
	50							
	95							
	130						Boulder	
	245							
	190	3	11	21	18			
	130							
	230							
10'	196							
	185	4	16	27	60			
	370							
	225						Moist brown sand, some gravel, trace of silt	
	240							
	193							
	75							
	143	5	10	30	30			
	150							
	155							
20'	196							
	60	6	15	56	55			
	125							
	175							
	300						NOTE: Drilled open hole from 25' to 30'6"	
	370							
		7	35	54	61			
30'								
							Bottom of boring 30'6"	
							*Water encountered at 9'.	
40'								
50'								

THE SUBSURFACE INFORMATION SHOWN HEREON WAS OBTAINED FOR STATE DESIGN AND ESTIMATE PURPOSES. IT IS MADE AVAILABLE TO AUTHORIZED USERS ONLY THAT THEY MAY HAVE ACCESS TO THE SAME INFORMATION AVAILABLE TO THE STATE. IT IS PRESENTED IN GOOD FAITH, BUT IS NOT INTENDED AS A SUBSTITUTE FOR INVESTIGATIONS, INTERPRETATION OR JUDGMENT OF SUCH AUTHORIZED USERS.

CONTRACTOR _____ SM _____

DRILL RIG OPERATOR Michael Betanzos
SOIL & ROCK DESCRIP. R. B. Hanke
REGIONAL SOILS ENGR. [signature]
SHEET 1 OF 1
STRUCTURE NAME/NO.

HOLE DND-3

SM 282d (2/72)

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
SOIL MECHANICS BUREAU

SUBSURFACE EXPLORATION LOG

REGION 8
COUNTY Ulster
PIN E10,300 701.19
PROJECT Proposed Dam at Belaire Mtn. Ski Center
SOIL SERIES
COORD. LOC. N778,635 E465,520
DATE START 4-30-73 DATE FINISH 5-1-73

HOLE DND-4
LINE BSM B
STA 1+46
OFFSET 60' Rt.
SURF. ELEV. 1733.2
DEPTH TO WATER *

CASING O.D. 4½" I.D. 4" WEIGHT OF HAMMER - CASING 300 LBS. HAMMER FALL - CASING 18 IN.
SAMPLER O.D. 3½" I.D. 3" WEIGHT OF HAMMER - SAMPLER 300 LBS. HAMMER FALL - SAMPLER 18 IN.

DEPTH BELOW SURFACE	BLOWS ON CASING	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	DESCRIPTION OF SOIL AND ROCK	MOIST. CONT. %
0	12	S-1	4	8	17		Moist brown sand & gravel	
	28							
	56							
	160							
	170							
	120	2	24	33	56			
	100							
	181							
	357							
10'	350							
		3	47	63	120		Moist grey gravel, some sand, tr. silt	
							BOULDER FROM 11'6" TO 16' Drilled with quarry bit	
		4	68	48	60		Wet red sand; BOULDER fragments, tr. silt	
							From 16' 6" to 20' small boulders Drilled with quarry bit	
20'		5	105	120	124		Moist grey sand, some BOULDER fragments	
							Bottom of boring 21' 6"	
							*Water encountered at 13'	
30'								
40'								
50'								

THE SUBSURFACE INFORMATION SHOWN HEREON WAS OBTAINED FOR STATE DESIGN AND ESTIMATE PURPOSES. IT IS MADE AVAILABLE TO AUTHORIZED USERS ONLY THAT THEY MAY HAVE ACCESS TO THE SAME INFORMATION AVAILABLE TO THE STATE. IT IS PRESENTED IN GOOD FAITH, BUT IS NOT INTENDED AS A SUBSTITUTE FOR INVESTIGATIONS, INTERPRETATION OR JUDGMENT OF SUCH AUTHORIZED USERS.

CONTRACTOR _____ SM _____

DRILL RIG OPERATOR D. Olson
SOIL & ROCK DESCRIP. B. B. Hanke
REGIONAL SOILS ENGR.
SHEET 1 OF 1
STRUCTURE NAME/NO.

HOLE DND-4

SM 282d (2/72)

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
SOIL MECHANICS BUREAU

SUBSURFACE EXPLORATION LOG

REGION 8
COUNTY Ulster
PIN E10,300 701.19
PROJECT Proposed Dam at Belair Mtn. Ski Center
SOIL SERIES
COORD. LOC. N778,670 E465,510
DATE START 5-7-73 DATE FINISH 5-8-73

HOLE DND-5
LINE BSM ℄
STA 1+44
OFFSET 126' Rt.
SURF. ELEV. 1734.4
DEPTH TO WATER *

CASING O.D. 4½" I.D. 4" WEIGHT OF HAMMER - CASING 300 LBS. HAMMER FALL - CASING 18 IN.
SAMPLER O.D. 3⅜" I.D. 3" WEIGHT OF HAMMER - SAMPLER 300 LBS. HAMMER FALL - SAMPLER 18 IN.

DEPTH BELOW SURFACE	BLOWS ON CASING	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	DESCRIPTION OF SOIL AND ROCK	MOIST. CONT. %
0	10	1	3	13	15		Moist brown topsoil, some sand & gravel	
	21							
	63							
	105							
	120							
	42	2	20	26	45		Moist brown sand & gravel, some silt	
	50							
	60							
	135							
10'	250							
	100	3	48	48	54			
	100							
	145							
	165						Moist red sand & gravel, tr. silt	
	221							
	178	4	50	35	45			
	238							
	207							
	210							
20'	239							
	206	5	90	96	235			
	275							
	320							
	318							
	322							
		6	34	85				
					128	220		
							Bottom of boring 27'	
30'								
							*Water encountered at 16'	
40'								
50'								

THE SUBSURFACE INFORMATION SHOWN HEREON WAS OBTAINED FOR STATE DESIGN AND ESTIMATE PURPOSES. IT IS MADE AVAILABLE TO AUTHORIZED USERS ONLY THAT THEY MAY HAVE ACCESS TO THE SAME INFORMATION AVAILABLE TO THE STATE. IT IS PRESENTED IN GOOD FAITH, BUT IS NOT INTENDED AS A SUBSTITUTE FOR INVESTIGATIONS, INTERPRETATION OR JUDGMENT OF SUCH AUTHORIZED USERS.

CONTRACTOR _____ SM _____

DRILL RIG OPERATOR D. Olson
SOIL & ROCK DESCRIP. R. B. Hanke
REGIONAL SOILS ENGR. [signature]
SHEET 1 OF 1
STRUCTURE NAME NO. _____

HOLE DND-5

SM 282d (2/72)

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
SOIL MECHANICS BUREAU

SUBSURFACE EXPLORATION LOG

REGION 8
COUNTY Ulster
PIN E103.00
PROJECT Proposed Dam at Belair Mtn. Ski Center
SOIL SERIES
COORD. LOC. N 778,795 E 465,460
DATE START 5-8-73 DATE FINISH 5-14-73

HOLE DAD-7
LINE $\mathcal{L}$ "BSM"
STA 1+28
OFFSET 238' Rt.
SURF. ELEV. 176
DEPTH TO WATER *

CASING O.D. 2-3/4" I.D. 2½" WEIGHT OF HAMMER - CASING 300 LBS. HAMMER FALL - CASING 18 IN.
SAMPLER O.D. 2" I.D. 1-3/8" WEIGHT OF HAMMER - SAMPLER 300 LBS. HAMMER FALL - SAMPLER 18 IN.

DEPTH BELOW SURFACE	BLOWS ON CASING	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	DESCRIPTION OF SOIL AND ROCK	MOIST. CONT. %
0	7	1	3	6				
	17				13			
	38							
	47							
	7							
	27	2	32	35				
	35				38			
	63							
	109							
10'	111							
	72	3	25	44				
	96				47			
	123							
	84							
	92							
	49	4	38	39			Moist brown sand, some travel, tr. of silt	
	31				52			
	81							
	83							
20'	102							
	17	5	34	52				
	50				97			
	88							
	70							
	107							
	41	6	44	83				
	102				38			
	116							
	122							
30'	158							
	173	7	41	45				
	52				45			
	76							
	116							
	206							
	211	8	46	137				
	61				141			
	101							
	107							
40'	128							
	170	9	94	90+				
	139				52			
	80							
	153							
	174							
	222	10	45	85				
	272				50			
	85							
	106							
50'	94							

THE SUBSURFACE INFORMATION SHOWN HEREON WAS OBTAINED FOR STATE DESIGN AND ESTIMATE PURPOSES. IT IS MADE AVAILABLE TO AUTHORIZED USERS ONLY THAT THEY MAY HAVE ACCESS TO THE SAME INFORMATION AVAILABLE TO THE STATE. IT IS PRESENTED IN GOOD FAITH, BUT IS NOT INTENDED AS A SUBSTITUTE FOR INVESTIGATIONS, INTERPRETATION OR JUDGMENT OF SUCH AUTHORIZED USERS.

CONTRACTOR _____ SM _____

DRILL RIG OPERATOR W. TOMPKINS
SOIL & ROCK DESCRIP. S. J. Hodos
REGIONAL SOILS ENGR. [signature]
SHEET 1 OF 2
STRUCTURE NAME/NO. _____

HOLE DAD-7

SM 282d (2/72)

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
SOIL MECHANICS BUREAU

SUBSURFACE EXPLORATION LOG

REGION 8
COUNTY Ulster
PIN E103.00
PROJECT Proposed Dam at Belair Mtn. Ski Center
SOIL SERIES
COORD. LOC. N 778,795 E 465,460
DATE START 5-8-73 DATE FINISH 5-14-73

HOLE DAD-7
LINE B "BSM"
STA 1+28
OFFSET 238' Rt.
SURF. ELEV. 1761.7
DEPTH TO WATER *

CASING O.D. 2-3/4" I.D. 2½" WEIGHT OF HAMMER - CASING 300 LBS. HAMMER FALL - CASING 18 IN.
SAMPLER O.D. 2" I.D. 1-3/8" WEIGHT OF HAMMER - SAMPLER 300 LBS. HAMMER FALL - SAMPLER 18 IN.

DEPTH BELOW SURFACE	BLOWS ON CASING	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	DESCRIPTION OF SOIL AND ROCK	MOIST. CONT. %
0	155							
	219	11	93				Moist brown sand, some gravel, tr. of silt	
	162							
	236							
	350							
	600							
	870							
		12		46				
					95	84		
60'							Bottom of boring 59'	
							*Unable to obtain water level	
70'								
80'								
90'								
100'								

THE SUBSURFACE INFORMATION SHOWN HEREON WAS OBTAINED FOR STATE DESIGN AND ESTIMATE PURPOSES. IT IS MADE AVAILABLE TO AUTHORIZED USERS ONLY THAT THEY MAY HAVE ACCESS TO THE SAME INFORMATION AVAILABLE TO THE STATE. IT IS PRESENTED IN GOOD FAITH, BUT IS NOT INTENDED AS A SUBSTITUTE FOR INVESTIGATIONS, INTERPRETATION OR JUDGMENT OF SUCH AUTHORIZED USERS.

CONTRACTOR _____ SM _____

DRILL RIG OPERATOR W. Tompkins
SOIL & ROCK DESCRIP. S. J. Hodos
REGIONAL SOILS ENGR. J. M. Mason
SHEET 2 OF 2
STRUCTURE NAME/NO. _____

HOLE DAD-7

SM 282d (2/72)

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
SOIL MECHANICS BUREAU

SUBSURFACE EXPLORATION LOG

REGION 8
COUNTY Ulster
PIN E10,300 701.19
PROJECT PROPOSED DAM AT BELAIR MTN. SKI CENTER
SOIL SERIES
COORD. LOC. N 778,620 E 465,460
DATE START 5-2-73 DATE FINISH 5-3-73

HOLE DAD-8
LINE B "BSM"
STA 2+07
OFFSET 65' Rt.
SURF. ELEV. 1738.9
DEPTH TO WATER *

CASING O.D. 2-7/8" I.D. 2½" WEIGHT OF HAMMER - CASING 300 LBS. HAMMER FALL - CASING 18 IN.
SAMPLER O.D. 2", I.D. 1-3/8" WEIGHT OF HAMMER - SAMPLER 300 LBS. HAMMER FALL - SAMPLER 18 IN.

DEPTH BELOW SURFACE	BLOWS ON CASING	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	DESCRIPTION OF SOIL AND ROCK	MOIST. CONT. %
0	5	1	2	4	6		Moist brown sand, tr. silt - rock fragments (topsoil)	
	13							
	23							
	48							
	57							
	108	2	19	16	20		Moist brown sand, some gravel, tr. of silt	
	152							
	110							
	135							
10'	148							
	30	3	8	13	16			
	63							
	140							
	346							
	370							
	144							
	120						Small boulders (drilled with quarry bit) from 15' to 20'	
	210							
	325							
20'	335							
	470	4	90	100 on 1"			Moist brown gravel, tr. silt	
							Small boulders (drilled with quarry bit) From 20'7" to 25'	
		5	83	75			Moist red sand, some gravel, tr. silt	
					38	68		
							Bottom of boring 27'	
30'								
							*Water encountered at 14'9"	
							NOTE: Sample #5 taken with a 1-3/8" solid barrel sampler.	
40'								
50'								

THE SUBSURFACE INFORMATION SHOWN HEREON WAS OBTAINED FOR STATE DESIGN AND ESTIMATE PURPOSES. IT IS MADE AVAILABLE TO AUTHORIZED USERS ONLY THAT THEY MAY HAVE ACCESS TO THE SAME INFORMATION AVAILABLE TO THE STATE. IT IS PRESENTED IN GOOD FAITH, BUT IS NOT INTENDED AS A SUBSTITUTE FOR INVESTIGATIONS, INTERPRETATION OR JUDGMENT OF SUCH AUTHORIZED USERS.

CONTRACTOR _____ SM _____

DRILL RIG OPERATOR D. Olson
SOIL & ROCK DESCRIP. S. J. Hodos
REGIONAL SOILS ENGR. [signature]
SHEET 1 OF 1
STRUCTURE NAME/NO.

HOLE DAD-8

SM 282d (2/72)

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
SOIL MECHANICS BUREAU

SUBSURFACE EXPLORATION LOG

REGION 8
COUNTY Ulster
PIN E103.00-701-12
PROJECT Proposed Dam at Belair Mtn. Ski Center
SOIL SERIES
COORD. LOC. N778,365 E465,605
DATE START 5-4-73 DATE FINISH 5-16-73

HOLE DAD-9
LINE BSM B
STA 0+72
OFFSET 35' Rt.
SURF. ELEV. 1722.6
DEPTH TO WATER *

CASING O.D 2-3/4" I.D. 2½" WEIGHT OF HAMMER - CASING 300 LBS. HAMMER FALL - CASING 18 IN
SAMPLER O.D. 2" I.D 1-3/8" WEIGHT OF HAMMER - SAMPLER 300 LBS. HAMMER FALL - SAMPLER 18 IN

DEPTH BELOW SURFACE	BLOWS ON CASING	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	DESCRIPTION OF SOIL AND ROCK	MOIST CONT %
0	27	1					#1 Dug by hand	11
	33	2	3	5	7			6
	39							
	42						Moist brown sand & gravel, trace of silt	
	45							
	106	3	14	14	26			
	122							
	135							
	140							
10'	133							
	55	4	10	6	10			
	49							
	83						Moist brown silt, some sand and gravel	
	90							
	47							
	78	5	7	9	23			
	107							
	125							
	280							
20'	66							
	91	6	24	28	36			
	137							
	145							
	177							
	113						Moist brown sand & gravel, some silt	
	87							
	105							
	156							
	137							
30'	118	7	30	42	45			
	114							
	105							
	110							
	125	8	55	94	97			
	200							
	222							
	109							
	120							
	150							
40'	210							
	216							
	114							
	138							
	205	9	20	71				
	325							
	400							
	130							
	115							
	220							
50'	1650							

THE SUBSURFACE INFORMATION SHOWN HEREON WAS OBTAINED FOR STATE DESIGN AND ESTIMATE PURPOSES. IT IS MADE AVAILABLE TO AUTHORIZED USERS ONLY THAT THEY MAY HAVE ACCESS TO THE SAME INFORMATION AVAILABLE TO THE STATE. IT IS PRESENTED IN GOOD FAITH, BUT IS NOT INTENDED AS A SUBSTITUTE FOR INVESTIGATIONS, INTERPRETATION OR JUDGMENT OF SUCH AUTHORIZED USERS.

CONTRACTOR _____ SM _____

DRILL RIG OPERATOR Michael Betanzos
SOIL & ROCK DESCRIP. S. J. Hodos
REGIONAL SOILS ENGR. [signature]
SHEET 1 OF 2
STRUCTURE NAME/NO.

HOLE DAD-9

SM 282d (2/72)

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
SOIL MECHANICS BUREAU

SUBSURFACE EXPLORATION LOG

REGION 8
COUNTY Ulster
PIN E103.00 701-19
PROJECT Proposed Dam at Belair Mtn. Ski Center
SOIL SERIES
COORD. LOC. N778,635 E465,605
DATE START 5-4-73 DATE FINISH 5-16-73

HOLE DAD-9
LINE BSM ℄
STA 0+72
OFFSET 35' Rt.
SURF. ELEV. 1722.6
DEPTH TO WATER *

CASING O.D. 2-3/4" I.D. 2½" WEIGHT OF HAMMER - CASING 300 LBS. HAMMER FALL - CASING 18 IN
SAMPLER O.D. 2" I.D. 1-3/8" WEIGHT OF HAMMER - SAMPLER 300 LBS. HAMMER FALL - SAMPLER 18 IN

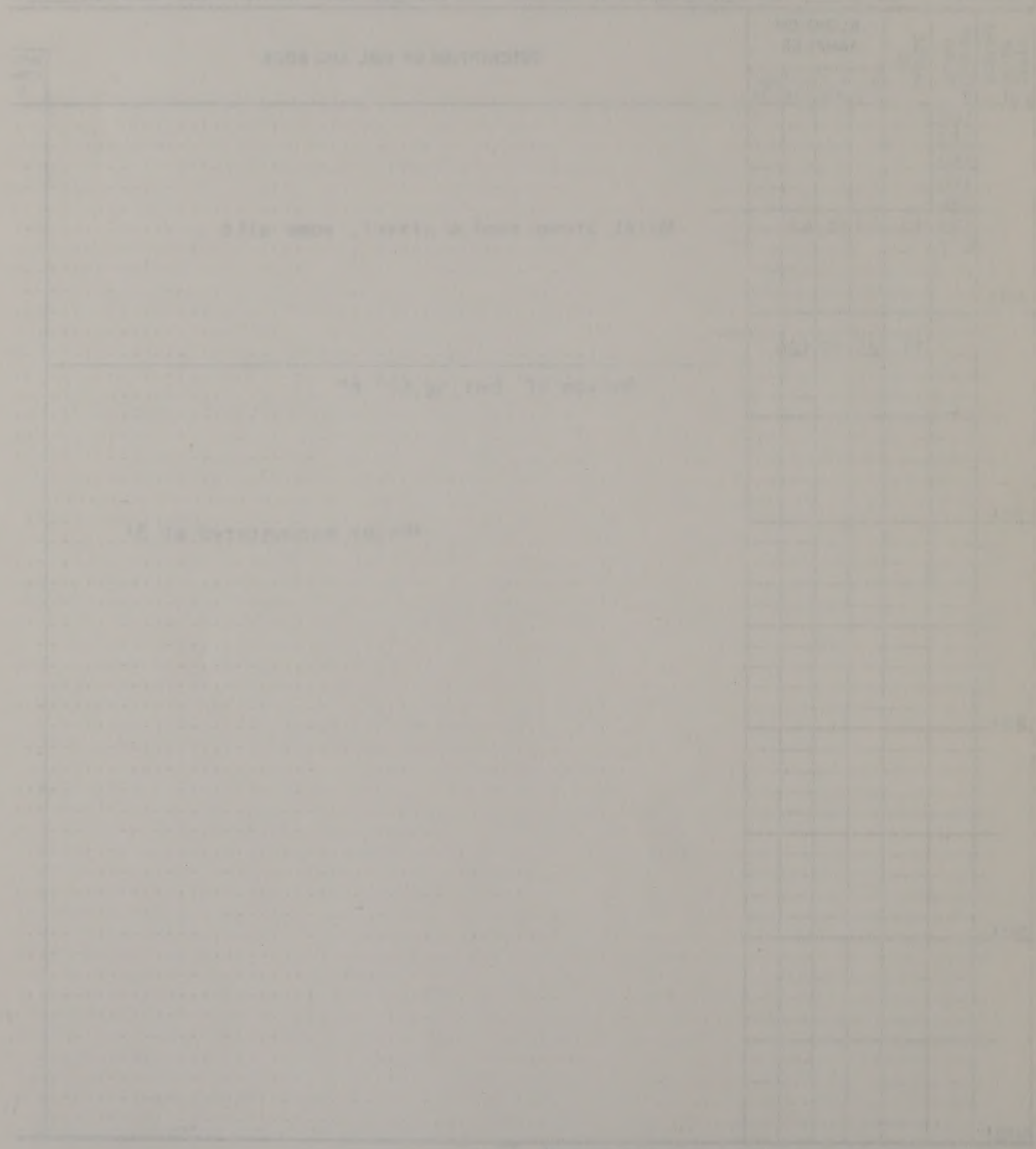
DEPTH BELOW SURFACE	BLOWS ON CASING	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	DESCRIPTION OF SOIL AND ROCK	MOIS CON %
50'								
	145							
	255							
	282							
	356							
	384							
	537	10	25	56	61		Moist brown sand & gravel, some silt	
	417							
60'								
		11	25	57	126			
							Bottom of boring 62' 6"	
70'							*Water encountered at 8'	
80'								
90'								
100'								

THE SUBSURFACE INFORMATION SHOWN HEREON WAS OBTAINED FOR STATE DESIGN AND ESTIMATE PURPOSES. IT IS MADE AVAILABLE TO AUTHORIZED USERS ONLY THAT THEY MAY HAVE ACCESS TO THE SAME INFORMATION AVAILABLE TO THE STATE. IT IS PRESENTED IN GOOD FAITH, BUT IS NOT INTENDED AS A SUBSTITUTE FOR INVESTIGATIONS, INTERPRETATION OR JUDGMENT OF SUCH AUTHORIZED USERS.

CONTRACTOR _____ SM _____

DRILL RIG OPERATOR Michael Betanzos
SOIL & ROCK DESCRIP. S. J. Dodos
REGIONAL SOILS ENGR. W. M. Manning
SHEET 2 OF 2
STRUCTURE NAME/NO. _____

HOLE DAD-9



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